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WAR MACHINE

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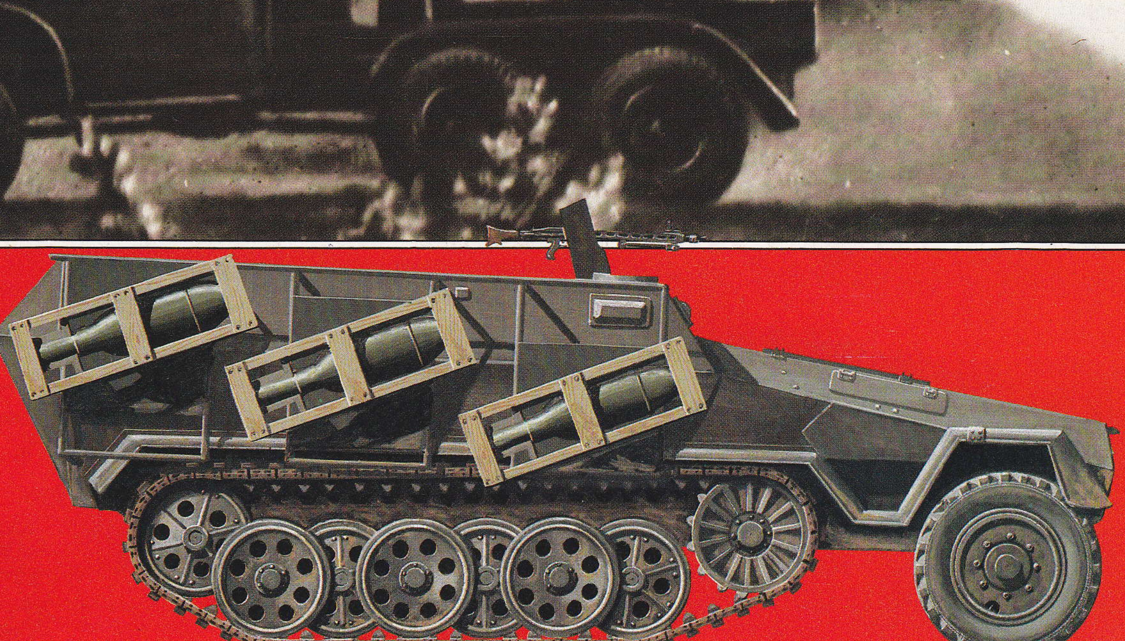
Kharkov: Prelude to Stalingrad

Rockets of the West



A fully illustrated guide to War Rockets of World War II

WAR MACHINE

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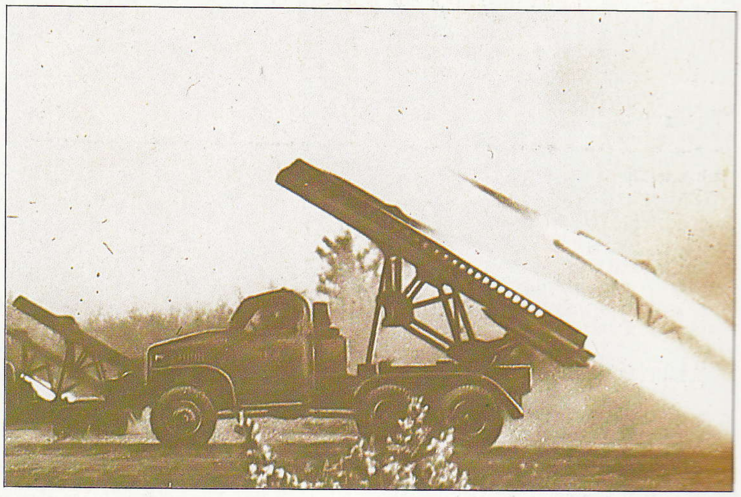
War Rockets of World War II

Used to attack strongpoints, lay smokescreens and simply to support the fire of conventional artillery, the rockets of World War II are most famous for their use in massive bombardments on the Eastern Front. Firing them in huge numbers could more than compensate for their inaccuracy.



The most widely used rockets of World War II were the Russian 'Katyushas'. Generally mounted on trucks, they provided the Red Army with awesome firepower. Since the war they have seen widespread service in the hands of Soviet allies.

The war rocket is an old weapon that was resurrected during World War II to supplement existing attack and defence systems (artillery and anti-aircraft weapons). The rocket has much to offer the weapon designer as it is a relatively cheap and simple device that can be mass produced with comparative ease, and when used en masse is capable of fearful devastation. But in the term en masse lies the main failing of the war rocket: it has to be used in great numbers to ensure that it will hit a precise target, for the rocket is inherently a projectile that will depart from a pre-selected trajectory with alarming ease and with little apparent reason. Set against this is the fact that it can carry a powerful payload for the costs involved, and so the arguments for and against such weapons continue.

The arguments for the rocket were in the ascendancy during World War II, nearly all the major protagonists making operational use of them to some degree. Mainly it was to supplement existing weapons, but the Soviets discovered that the rocket could at times be regarded as a weapon in its own right. Technologically the Germans were the most advanced of all the World War II users, but they operated rockets as a supporting weapon to eke out artillery barrages, and only rarely attempted to deploy their rocket systems in the same offensive manner as the Red Army used its various Katyushas. The Katyushas were nearly always in the forefront of the offensive to oust the German invaders from the Soviet Union, and some of the Soviet rocket types used during those times are still in service all over the world. Indeed the Red Army has maintained the multiple rocket-launcher as an important item in its military inventory, and has improved the performance of the relevant rockets to an extraordinary degree. Only now are the Western nations beginning to relearn the importance of this weapon as a counter to massed armoured and infantry attacks.

But during World War II the rocket made a considerable impact on many ground campaigns. The German Nebelwerfer units often tipped the balance in their application of heavy barrage fire during several battles, and over the UK British rocket batteries played their part in the defence of the nation. At lower tactical levels the various American M8 weapons were often used to devastating effect in the reduction of strongpoints and bunkers. Only the Japanese failed to use the rocket to its full effect. They did make some attempts in this direction, but for them the main problem was production, not tactics.

The fire controller of the 1st Canadian rocket projector unit looks towards German positions opposite 12 Corps, 15 January 1945. The Canadian barrage is poised to begin, the rocket crewmen having made themselves scarce to avoid the fearsome backblast.

GERMANY

15-cm Wurfgranate 41

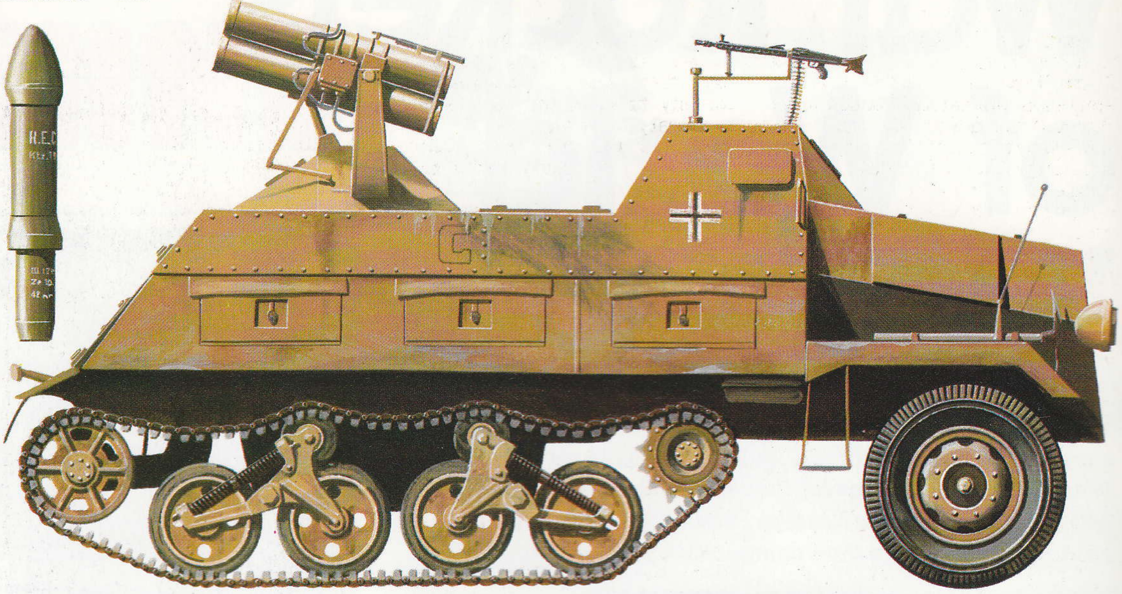
The 15-cm (5.9-in) German artillery rockets were the mainstay of the large number of German army Nebelwerfer (literally smoke-throwing) units, initially formed to produce smoke screens for various tactical uses but later diverted to use artillery rockets as well. The 15-cm (5.9-in) rockets were extensively tested by the Germans at Kummersdorf West during the late 1930s, and by 1941 the first were ready for issue to the troops.

The 15-cm (5.9-in) rockets were of two main types: the **15-cm Wurfgranate 41 Spreng** (high explosive) and **15-cm Wurfgranate 41 w Kh Nebel** (smoke). In appearance both were similar and had an unusual layout, in that the rocket venturi that produced the spin stabilization were located some two-thirds of the way along the rocket body with the main payload behind them. This ensured that when the main explosive payload detonated the remains of the rocket motor added to the overall destructive effects. In flight the rocket had a distinctive droning sound that gave rise to the Allied nickname 'Moaning Minnie'. Special versions were issued for arctic and tropical use.

The first launcher issued for use with these rockets was a single-rail device known as the 'Do-Gerät' (after the leader of the German rocket teams, General Dornberger). It was apparently intended for use by airborne units, but in the event was little used. Instead the main launcher for the 15-cm (5.9-in) rockets was the **15-cm Nebelwerfer 41**. This fired six rockets from tubular launchers carried on a converted 3.7-cm Pak 35/36 anti-tank gun carriage. The tubes were arranged in a rough circle and were fired electrically one at a time in a fixed sequence. The maximum range of these rockets was variable, but usually about 6900 m (7,545 yards), and they were normally fired en masse by batteries of 12 or more launchers. When so used the effects of such a bombardment could be devastating as the rockets could cover a considerable area of target terrain and the blast of their payloads was powerful.

On the move the Nebelwerfer 41s were usually towed by light halftracks that also carried extra ammunition and other equipment, but in 1942 a halftracked launcher was issued. This was the **15-cm Panzerwerfer 42** which continued to use the 15-cm (5.9-in) rocket with the launcher tubes arranged in two horizontal rows of five on the top of an SdKfz 4/1 Maultier armoured halftrack. These vehicles were used to supply supporting fire for armoured operations. Up to 10 rockets could be carried ready for use in the launcher and a further 10 weapons inside the armoured body. Later in the war similar launchers were used on armoured schwere Wehrmachtschlepper (SWS) halftracks that were also used to tow more Nebelwerfer 41s. The SWS could carry up to 26 rockets inside its armoured hull.

The 15-cm (5.9-in) rockets were also used with the launchers intended for the 30-cm (11.8-in) rockets, with special rails for the smaller rockets fitted into the existing 30-cm (11.8-in) launcher rails.



Above: The 15-cm Panzerwerfer 42 was not only more mobile, but more survivable; rockets betrayed their position the moment they fired, so to avoid enemy artillery fire they needed to change position rapidly.

The 15-cm rockets were among the earliest in widespread use by the German army, following an extensive pre-war test programme.

Originally fired from a 6-barrel mount converted from the Pak 35/36 gun carriage, by 1942 the 10-tube launcher had been developed.

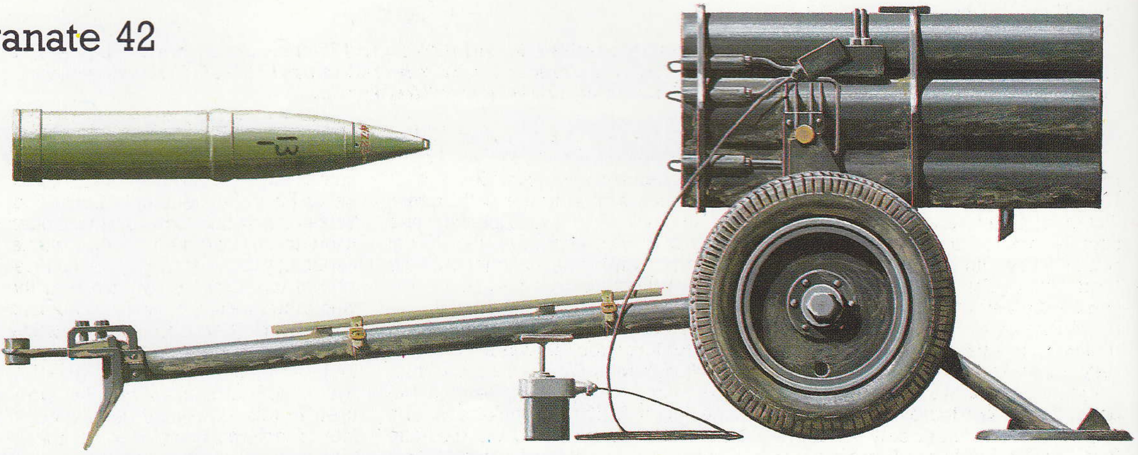
Specification
15-cm Wurfgranate 41 Spreng
Dimensions: length 979 mm (38.55 in); diameter 158 mm (6.22 in)
Weights: overall 31.8 kg (70 lb); propellant 6.35 kg (14 lb); filling 2.5 kg (5.5 lb)
Performance: initial velocity 342 m (1,120 ft) per second; range 7055 m (7,715 yards)

Specification
15-cm Wurfgranate 41 w Kh Nebel
Dimensions: length 1.02 m (40.16 in); diameter 158 mm (6.22 in)
Weights: overall 35.9 kg (79 lb); propellant 6.35 kg (14 lb); filling 3.86 kg (8.5 lb)
Performance: initial velocity 342 m (1,120 ft) per second; range 6905 m (7,550 yards)

GERMANY

21-cm Wurfgranate 42

Following on from the success of their 15-cm (5.9-in) rockets, German designers decided to produce a larger rocket which by 1941 emerged as a 210-mm (8.27-in) design. At first sight this rocket, known as the **21-cm Wurfgranate 42 Spreng**, looked exactly like a conventional artillery projectile, but closer examination showed that the base had 22 angled venturi to impart the important spin stabilization. The long streamlined nose was also deceptive, for it was hollow and the warhead proper was located some distance from the tip. This rocket contained no less than 10.17 kg (22.4 lb) of high explosive, which on detonation produced a powerful blast effect. The weapon was so successful in this destructive role that only high explosive versions were produced.

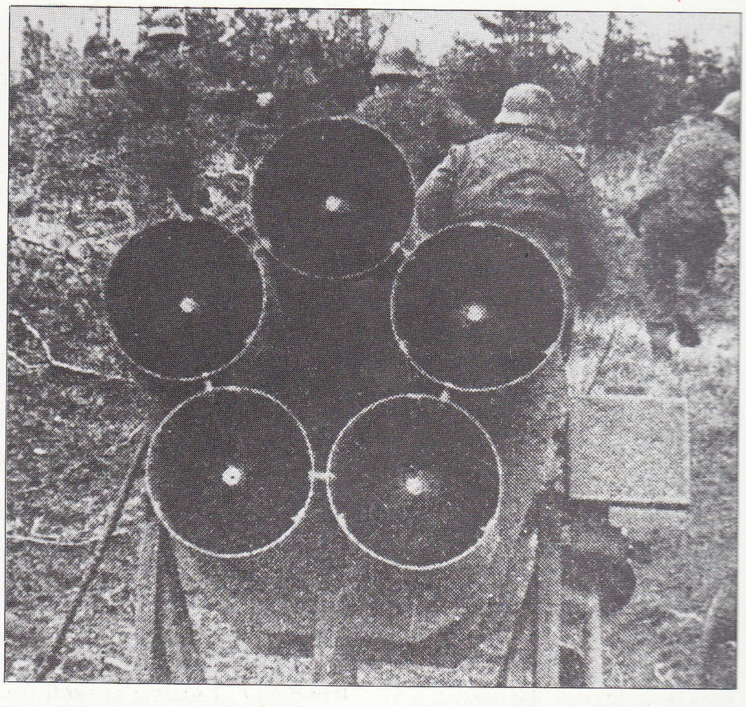


The 21-cm rocket superficially resembled a conventional artillery round, but its streamlined nose was hollow and its base had 22 angled venturi to produce spin stabilization.

The 21-cm (8.27-in) rocket was used with only one type of projector, the **21-cm Nebelwerfer 42**. The first such equipment appeared in action in the Soviet Union during 1943 as it took some time to finalize the launcher design. Originally this was to have been a simple enlargement of the existing 15-cm (5.9-in) Nebelwerfer 41 complete with six launcher tubes, but the larger calibre gave rise to some imbalance problems when the launcher was being towed and fired, so the number of tubes was eventually reduced to five and that solved the problems. In all other respects the carriage was the same as the earlier design and was a modification of the 3.7-cm (1.456-in) Pak 35/36 anti-tank gun carriage. As with the 15-cm (5.9-in) rockets the firing of the 21-cm (8.27-in) weapon was by electrical means. Once the rockets had been loaded in their tubes the launcher crew withdrew to a safe distance (or even took cover), and on receipt of the firing order one of the crew operated a special switch-gear box and the full load of rockets were fired one at a time in a fixed sequence. The salvo firing of the rockets produced a considerable amount of smoke and dust that revealed the launcher and battery position to the enemy, and during their trajectory the rockets produced their characteristic moaning noise that made them so distinctive a weapon. This combination of smoke, dust and noise meant that the Nebelwerfer troops had to be experts at getting in and out of action quickly, for any firing of the large salvoes necessary to cover a target quickly produced counterbattery artillery or rocket fire that could neutralize the launcher units.

The 21-cm (8.27-in) rockets made a considerable impression on all who had to endure their effects, and the Americans in particular considered the rocket and launcher design to be so far in advance of anything they could produce that they took some examples back to the USA and copied them. The US version was the 210-mm (8.27-in) **T36**, which was used for a series of trials and research programmes that did nothing to produce an operational weapon but which added considerably to the Americans' knowledge of artillery rocket technology.

Specification
21-cm Wurfgranate 42 Spreng
Dimensions: length 1.25 m (49.21 in); body diameter 210 mm (8.27 in)
Weights: overall 109.55 kg (241.5 lb); propellant 18.27 kg (40.25 lb); explosive 10.17 kg (22.4 lb)
Performance: initial velocity 320 m (1,050 ft) per second; range about 7850 m (8,585 yards)



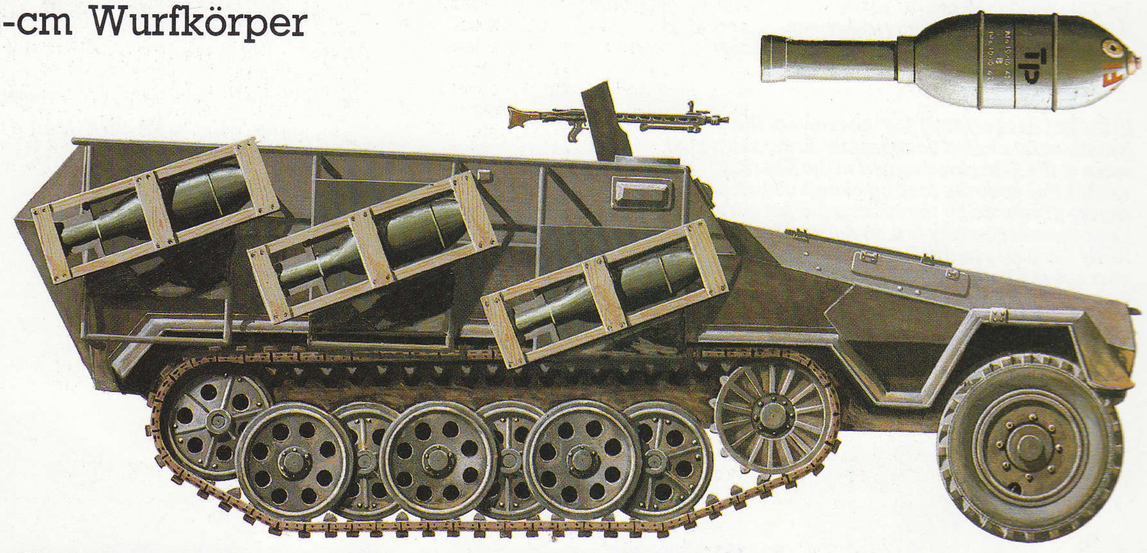
Entering service in 1943, the 21-cm Wurfgranate 42 was to have used the same carriage as the 15-cm rocket, but the number of tubes had to be reduced to five to compensate for the increased charge. The Americans were so impressed by the 21-cm weapon that they copied it.

GERMANY

28-cm and 32-cm Wurfkörper

The 28-cm (11-in) and 32-cm (12.6-in) rockets preceded the 15-cm (5.9-in) rockets in service with the German army, the first of them being issued for use during 1940. The two rockets shared the same rocket motor, but differed in their payload. Both were awkward and bulky rockets with a poor ballistic shape, but both had powerful payloads.

The smaller weapon was the **28-cm Wurfkörper Spreng**, which used a heavy high explosive warhead, while the larger weapon was the **32-cm Wurfkörper M F1 50** with an incendiary warhead in heavy liquid form. Both had a range limitation of just over 2000 m (2,185 yards) and were highly inaccurate despite their spin stabilization, and were consequently used en masse whenever possible. Counterbalancing these disadvantages was the fact that both were devastating in their effects if they hit a target, and the high explosive rocket was highly regarded for use in urban fighting where houses or other structures had to be demolished.



The short-ranged but powerful 28-cm and 32-cm rockets were among the first to be fitted to vehicles, in this case the ubiquitous SdKfz 251. This conversion was known as the 'Foot Stuka' or 'Howling Cow'.

Both rockets were issued to the troops in wooden carrying crates, or **Packkiste**. These crates doubled as launching frames and were fitted with simple forward supporting legs for rudimentary aiming purposes. In this form both rockets could be used by assault pioneers to demolish bunkers or strongpoints, but more often the rockets were used in batches of four resting on simple launcher frames known as the **schweres Wurfgerät 40** or **schweres Wurfgerät 41**, which differed from each other only in that the latter was tubular steel- rather than wooden-framed. Both could be used for pre-arranged barrages, as during the siege of Sevastopol in 1942. But this launching method was static, and to provide some form of mobility the **28/32-cm Nebelwerfer 41** was developed. This was a simple trailer with frames for six rockets in two superimposed rows of three, and after the 15-cm Nebelwerfer 41 this launcher was the most important early equipment of the Nebelwerfer units.

Another and still more mobile launcher for these rockets was the **schwerer Wurfrahmen 40**, in which six launcher frames were mounted on the sides of an SdKfz 251/1 half-track. The rockets were mounted on the side frames still in their carrying crates. Aiming was achieved by simply pointing the vehicle towards the target, and the rockets were then fired one at a time in a set sequence. This rocket/vehicle combination had several names but was often known as the 'Stuka-zu-Fuss' or 'heulende Kuh' (Foot Stuka or Howling Cow) and was often used to support Panzer operations, especially in the early days of the invasion of the Soviet Union. Later in the war other vehicles, usually captured French or other impressed vehicles, were used to bulk out the numbers of mobile launchers available. All manner of light armoured vehicles were used in this role, some carrying only four launchers. Many of these improvised launcher vehicles were used during the fighting in Normandy in 1944.

Specification
28-cm Wurfkörper Spreng
Dimensions: length 1.19 m (46.85 in); body diameter 280 mm (11 in)
Weights: overall 82.2 kg (181 lb); propellant 6.6 kg (14.56 lb); filling 49.9 kg (110 lb)
Performance: range about 2138 m (2,337 yards)

Specification
32-cm Wurfkörper M F1 50
Dimensions: length 1.289 m (50.75 in); body diameter 320 mm (12.6 in)
Weights: overall 79 kg (174 lb); propellant 6.6 kg (14.56 lb); filling 39.8 kg (87.7 lb)
Performance: range about 2028 m (2,217 yards)

Kharkov: Prelude to Stalingrad

In early 1942 the Germans were planning a massive offensive to defeat the Soviet Union before the next winter. Incredibly the Russians chose this moment to attack Kharkov where the Panzer armies were already massing for the assault.

The winter of 1941-2 shook the German army to the core. Not only was it the coldest winter for nearly 140 years, but the battles around the approaches to Moscow had led to defeat for the Germans and a shattering of the hopes and ambitions that had seemed so bright during the heady days of Operation 'Barbarossa' in the early months after June 1941. As the winter days lengthened and the snows began to melt, the Germans found themselves deep within the Soviet Union and facing the prospect of a new summer campaign.

The Red Army was in little better shape during those early days of 1942. The Moscow battles had absorbed the last of their reserves from the Far East armies, and for once the Red Army leaders faced the prospect that they were running short of men. Matériel was also in short supply. The uprooted industries that had been installed east of the Urals were hardly functioning as yet and the Red Army had to face the prospect that none could be expected to produce weapons for months to come.

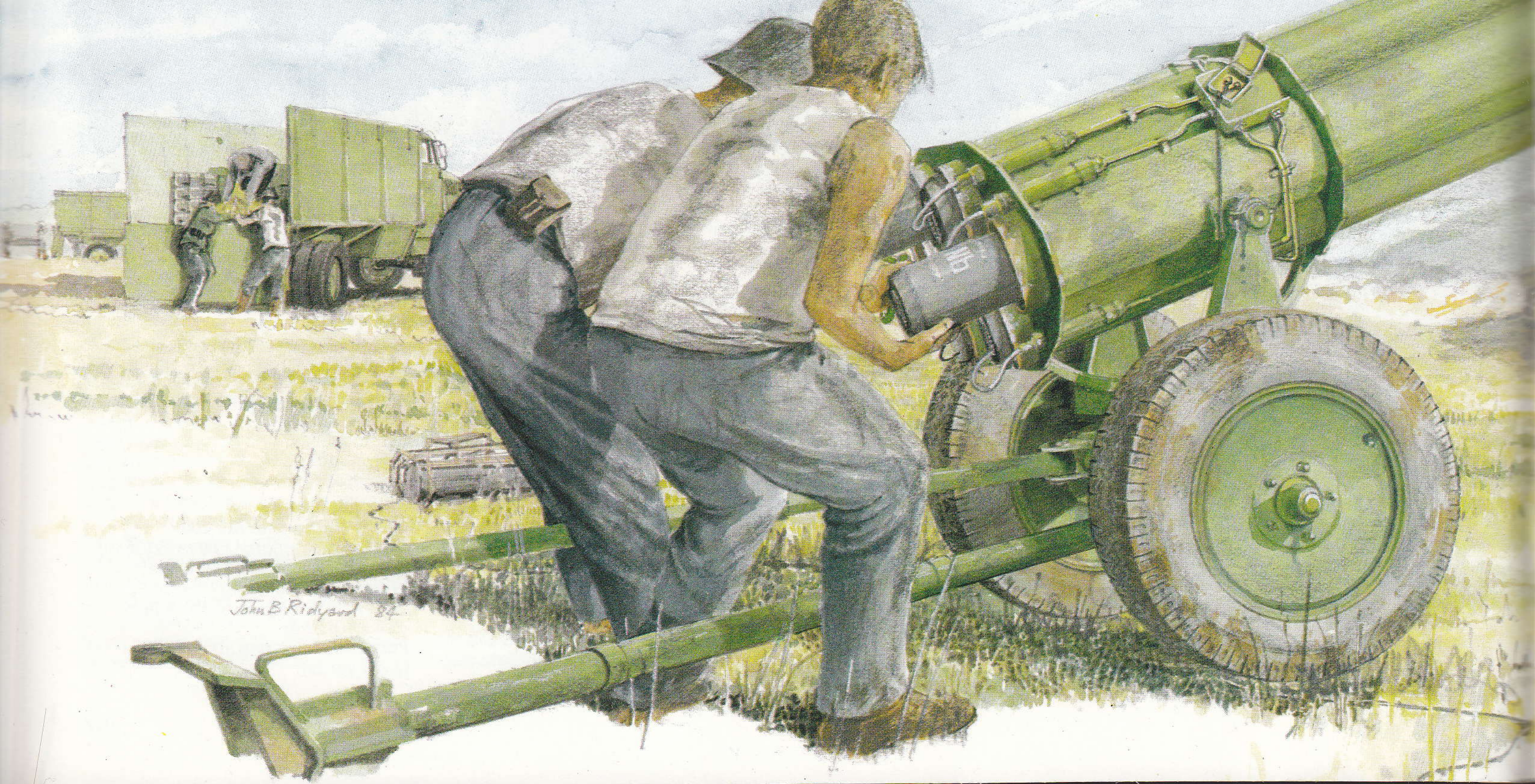
Even as the last battles in the snow were grinding to a halt the staff planners on both sides were making their plans. Those of the Red Army were only too aware of the shortages ahead and intended to make one last pre-emptive strike against the German army before the summer was far enough advanced for the Germans to make their expected moves. On the German side the high-level planning, conducted by Hitler himself, was less concerned with military gains than in economics. Hitler needed the oil resources of the Caucasus region, for oil was fast becoming the weakest point of the German war economy, and without it the armed forces and industry would grind to a halt. The German army staffs were therefore given wide objectives to achieve, but for them the accent was on military success and the oil question was hardly mentioned. Instead they planned a deep strike to the east and then north. The pivot of the northward strike, which was intended to reach beyond Moscow, was a city named Stalingrad, which was at that point only an interim objective. Following behind this massive move would be a deep strike to the Caucasus.

Hitler's plan

During the early months of 1942 the German army shook itself from its winter quarters and prepared for battle. The Panzer divisions reorganized and got new tanks. Also involved in a reorganization were the Nebelwerfer brigades: by early 1942 their structure had settled down to a point where the *Abteilung* (battalion) was the main sub-unit. An *Abteilung* had a headquarters staff and battery plus two or three fire batteries. If more than one battery was equipped with 21-cm (8.27-in) projectors it was known as a heavy battalion; the usual complement, however, was two 15-cm (5.9-in) batteries and one 21-cm battery. For the long-term objectives in the Caucasus there were even a few *Gebirgswerferabteilungen* (mountain rocket projector battalions), intended for use in the mountains to the south of the Caucasus. Each of these *Abteilungen* had its own organic anti-tank defence sections.

The Nebelwerfer units were to be very active in the months ahead, for even as the Germans organized their attacking forces the Soviets were pulling together what forces they could for a pre-emptive strike. Their objective was more modest than the German aims, for all they wanted to do was recapture Kharkov, one of the major cities of the Soviet Union. In order to prepare the way and divert some of the German reserves they started their campaign with a series of offensives in the approaches to the Crimea. These duly drew off the German

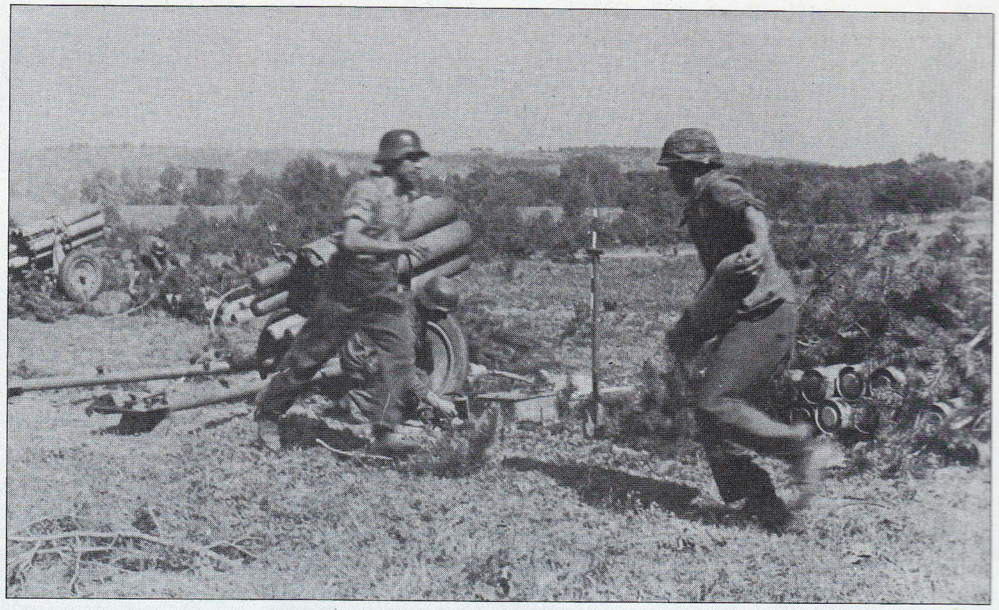
In the hot days of May 1942 the crews of the Nebelwerfers toiled unceasingly, firing salvo after salvo at the Russians trapped in the Kharkov salient. For once the soaring clouds of dust and smoke produced by the rockets did not attract a hail of counterbattery fire, as most of the Red Army's artillery had already been destroyed. The barrage at Kharkov prepared the way for the victorious charge across the steppes which was to end so catastrophically at Stalingrad.



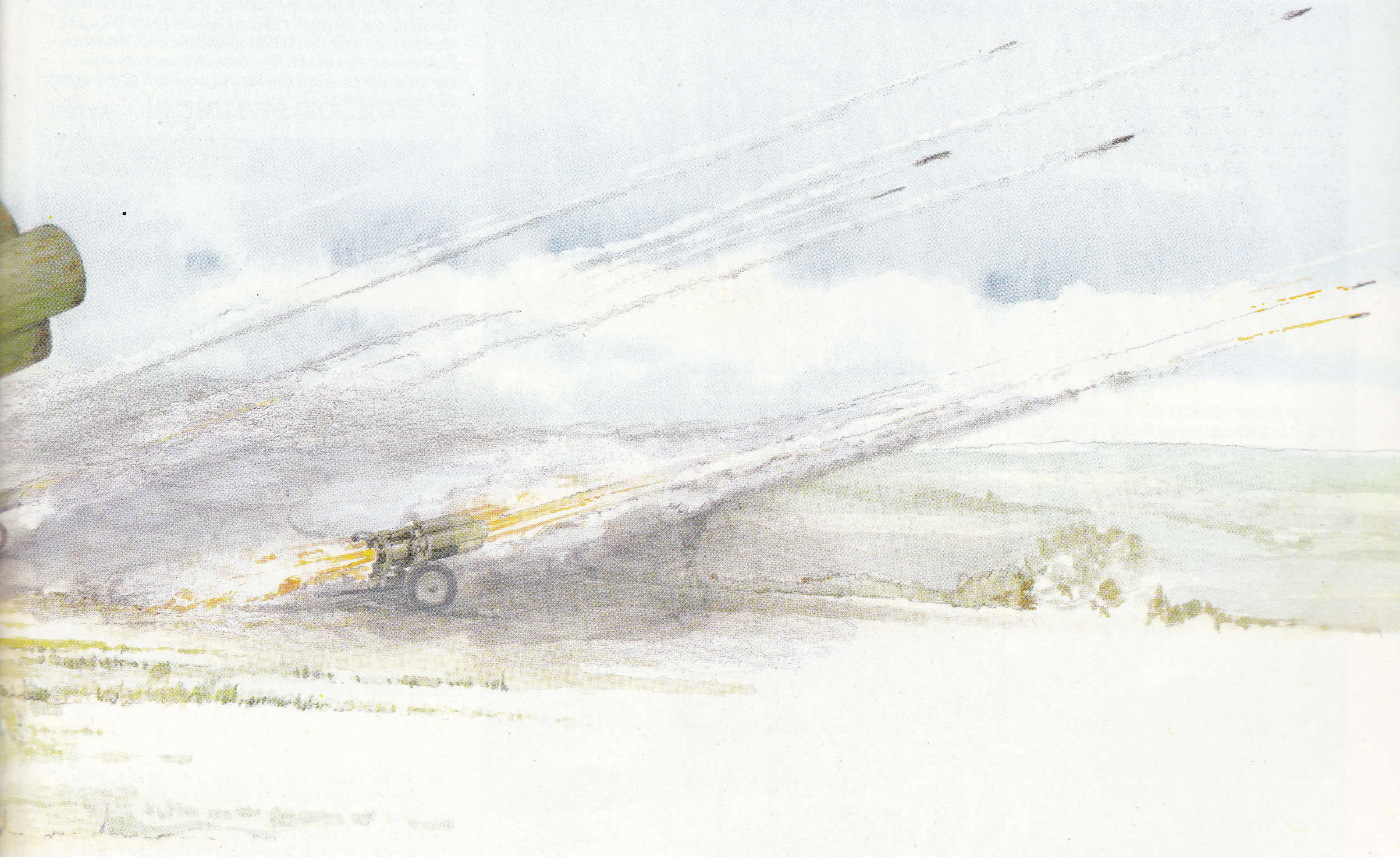
reserves, but at a high price, for the Soviet moves were all stalled by an elastic defence. In the end the Red Army withdrew from the Crimea region altogether, leaving Sevastopol to a lengthy siege. The Soviets then turned their attentions to the area near Balakleya, where the fighting of January 1942 had left a salient in the German front.

The Panzers gather

Unfortunately for the Soviets, the German army also had its eyes on the area, which was to be the launching point for the Germans' eastward advance. Behind this area, therefore, the Germans were building up, under the aegis of Army Group 'South', two primary groupings to be unveiled in July. The main force was Army Group 'B' consisting of the 2nd, 4th Panzer and 6th Armies, the last commanded by General Paulus, a name to be heard much in the year to come. Army Group 'A' had only two major German armies, the 17th and 1st Panzer, the balance of its strength being made up of a collection of satellite forces such as the Hungarians, Romanians, Italians and others. Commanded by Generalfeldmarschall List, this army group was to move south into the Caucasus with Baku as the objective for the spearhead formed by the 1st Panzer Army.



Above: Ammunition stacked ready to hand, the gunners race to reload their launchers. Once the launchers were full the crew retired to a safe distance, usually in a shelter trench, and fired the rockets electrically in pre-arranged sequence.



Kharkov: Prelude to Stalingrad

The unfortunate Red Army units were unwittingly moving right into the face of this massed array of force. Four Soviet formations (Group Bobrin and the 28th, 38th and 6th Armies of General Kostenko's South West Front) were ready to attack between Volchansk and Izyum about a week before the first German moves. Their idea was to sweep west and then south and north to cut off the German forces around Kharkov. In typical Red Army fashion their attack began on 12 May with a set-piece bombardment by artillery and massed Katyushas. The first attacks fell upon Romanian forces who promptly broke and moved to the west as fast as they could. The Soviets poured after them in hordes, horsed cavalry with T-34 tank support pursuing the hapless Romanians.

The trap is sprung

Unfortunatelay for them, the Soviets were advancing into a trap. As the Red Army tanks moved forward they were moving into a gap between two of the major forces arranging themselves for the German offensive: to their south was Gruppe Kleist (1st Panzer and 17th Armies) with all its German divisions intact and ready to move, and to the north was the 6th Army, also ready to move. As the Soviet attack moved west the German flanks held and the Red Army advance resembled a long thin pocket. Control of the Soviet forces was poor, for even as the threat to the westward advance was perceived the commanders were unable to do anything but continue the movement. Much of the Red Army's modern tank strength was committed to the attack, which simply had to work; it did not. On the morning of 17 May the German forces on the southern side of the long pocket unleashed their countermove. All along the front artillery and Nebelwerfer batteries heralded the advancing Panzers, which promptly cut across the neck of the Soviet advance and reached Izyum, the Red Army starting point. The bulk of the Soviet forces stretching to the west of Kharkov were trapped. Despite frantic efforts the Soviets were unable to move in any direction and were contained in a number of isolated battles whose only perceptible feature was a large force attempting to move north towards Kharkov while the forces to its rear broke up into small isolated groups.

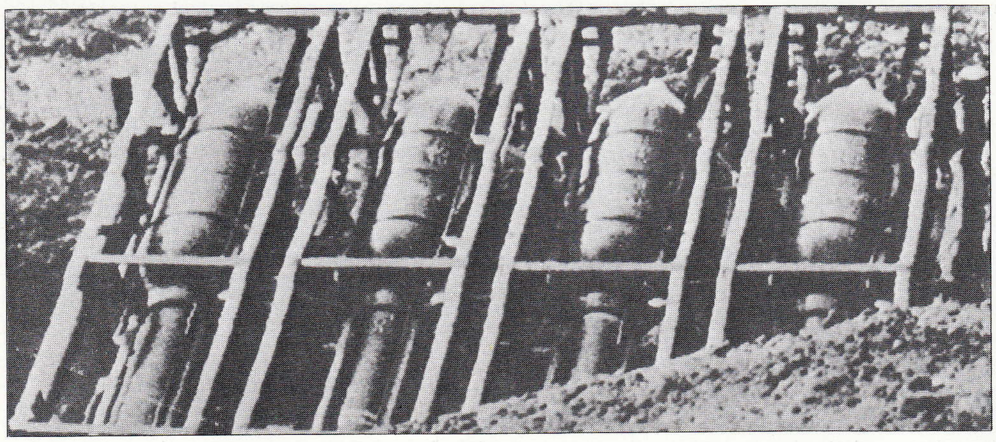
It was a field day for the Nebelwerfer batteries. With the Soviet units opposite them mainly separated from their supporting artillery, the Nebelwerfer batteries were able to bombard their enemies with little risk of the usual counter-battery fire invited by the clouds of dust and dirt kicked up by their heavily-smoking rockets. Instead of the usual rush in and out of firing locations they could take their positions at an almost leisurely pace, set up their projectors, load them with their bulky rockets and take cover with less than the common haste. Once firing had started, accompanied by the usual cacophony of howling and roaring, the German crews could simply reload and prepare for the next massed salvo. To their rear the halftracks and trucks brought up more ammunition while their targets suffered and awaited the next onslaught.

The end was not far off. On 19 May Paulus nipped off the last major Red Army forces near Balakleya and the remains of the Soviet 6th, 57th and 9th Armies fled to the east, leaving all their heavy equipment behind in their rush to cross the Donets. They lost hundreds of thousands of men, all their precious tanks, and masses of artillery and Katyushas, some of which were promptly turned against the fleeing Red Army.

On to Stalingrad

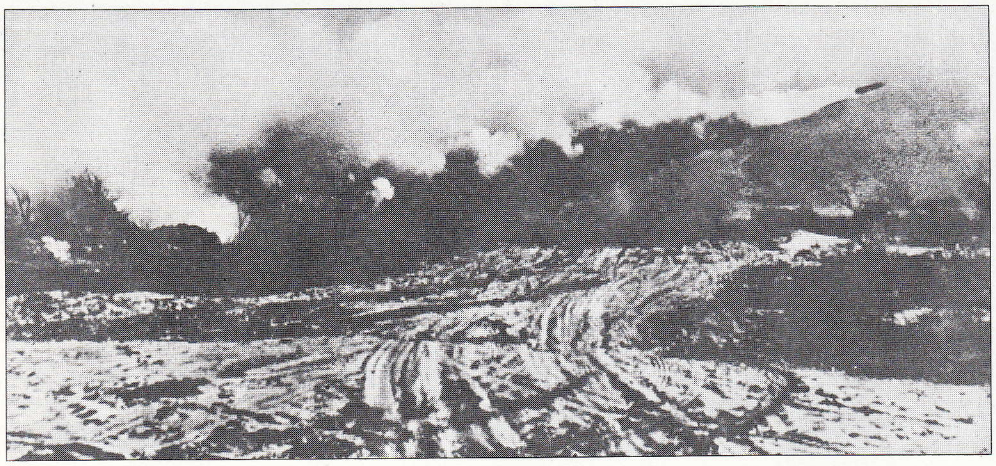
It was all a prelude to the coming summer campaign. In June the major German offensive duly opened and there was nothing to stop it. The losses of the Red Army in its ill-judged Kharkov offensive had sapped the last of its reserves and supplies of tanks. Beyond the Urals the factories were working around the clock in atrocious conditions to produce more weapons to replace those losses, but trained men were in short supply. The way was thus open for the great move towards Stalingrad, the last of the Panzers' great sweeps with the dreadful battles of the winter forgotten and replaced by a victorious rush across the steppes. To the south the 1st Panzer Army swept into the Caucasus and much of the oil-producing region was lost to the Soviets.

But in less than a year it was all to change. Stalingrad, which in the winter months was no more than a dot on the map, was to sap the last energies of the German forces in the east and the initiative was to pass to a newly enlivened Red Army.



Above: A row of 28/32 cm schweres Wurfgerät H1 rocket launchers await firing. These were often emplaced in echeloned groups of four to achieve maximum saturation of the target area. Carrying a powerful payload, they had a short range of little over 2000 m (2,187 yards).

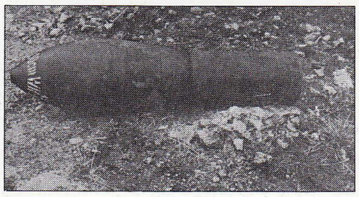
Below: With a deafening roar, the rockets blast off towards the target, leaving behind thick clouds of smoke – a clear invitation to enemy artillerymen. Fired in such a massive salvo, the rockets will completely blanket the target position in the space of a few seconds.



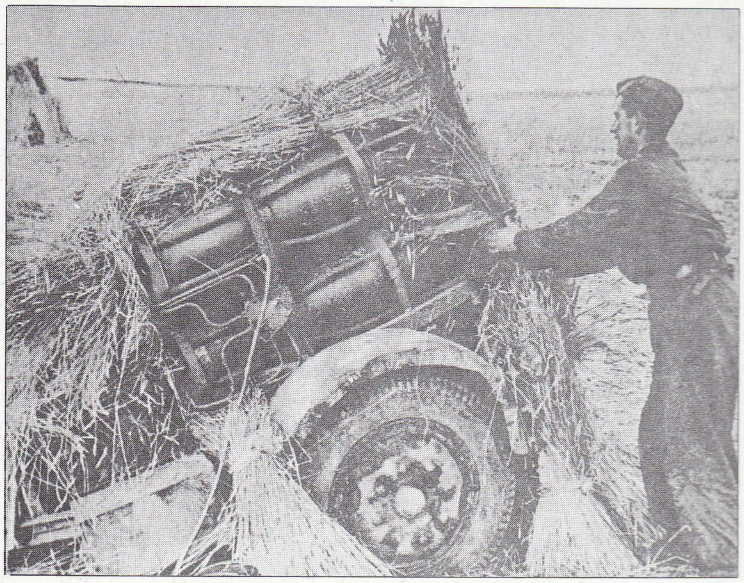
Left: A German rocket arches into the sky, kept roughly on course by its complex spin stabilization. Despite all the pressures of war, the Germans retained relatively sophisticated guidance systems, whereas the Russians relied on simple fin stabilization – and big salvoes.

GERMANY

30-cm Wurfkörper 42



Above: The 30-cm Wurfkörper 42 rocket was an improvement over its immediate predecessors, being much cleaner aerodynamically and leaving much less telltale smoke in its wake. Despite these advantages it could not be produced in sufficient quantity to supplant the earlier designs.



A gunner places some rather optimistic camouflage over a 30-cm rocket launcher. Initially fired from modified 28/32 cm launchers, the 30-cm rocket was soon provided with its own carriage, based on that of the 5-cm Pak 38 anti-tank gun.

Compared with 28-cm (11-in) and 32-cm (12.6-in) rockets which preceded it, the **30-cm Wurfkörper 42 Spreng** (also known as the **Wurfkörper Spreng 4491**) was a considerable improvement on the earlier designs when it appeared on the artillery scene during late 1942. Not only was it in aerodynamic terms a much smoother and cleaner design, but it had a much higher propellant/payload ratio than any other German artillery rocket. However, to the troops in the fields these technicalities were far less important than the fact that the more advanced type of propellant used with the new rocket produced far less smoke and exhaust trails than the other rockets, and was thus far less likely to give away the firing position. But for all this improvement the 30-cm (11.8-in) rocket did not have any marked range advantages over the existing rockets. It had a theoretical range of some 6000 m (6,560 yards), but practical ranges were of the order of 4550 m (4,975 yards).

The first launcher used with the new 30-cm (11.8-in) rockets was the **30-cm Nebelwerfer 42**. This was a simple conversion of the 28/32-cm Nebelwerfer 41 with the simple rail launching frames altered to accommodate the new rocket shape and size. But this simple conversion did not last long, for almost as it was issued a new programme of rationalization was drawn up and the special trailer of the Nebelwerfer 41 and 42 was eliminated. Instead a new trailer based on the carriage of the 5-cm (1.97-in) Pak 38 anti-tank gun was placed into production and the 30-cm (11.8-in) launcher frames were placed on this to produce the **30-cm Raketenwerfer 56**; to ensure that the new launcher could be used to the maximum each was provided with a set of launcher rail inserts to allow 15-cm (5.9-in) rockets to be fired if required. When not in use, these 15-cm (5.9-in) rails were stacked on top of the 30-cm (11.8-in) frames. Yet another rationalization was that the 30-cm (11.8-in) rockets could also be fired from the schwerer Wurfrahmen launcher frames of the SdKfz 251/1 half-track, originally intended for use by the 28-cm (11-in) and 32-cm (12.6-in) rockets. When launched from these frames, the 30-cm (11.8-in) rockets were fired from their carrying crates or Packkiste, and no doubt the 30-cm (11.8-in) rockets were used by assault pioneers for direct firing from their crates in the same manner as the earlier 28-cm (11-in) and 32-cm (12.6-in) weapons.

Despite its relative improvements over the earlier artillery rockets, the 30-cm (11.8-in) rocket was not used in very great numbers. The earlier rockets remained in service right until the end of the war despite a late attempt to replace all existing weapons, including the 30-cm (11.8-in) type, by an entirely new 12-cm (4.72-in) spin-stabilized design. This decision was made too late in the war for anything actually to reach the troops, and it now appears doubtful if any 12-cm (4.72-in) rockets were ever made.

Specification

30-cm Wurfkörper 42

Dimensions: length 1.23 m (48.44 in); body diameter 300 mm (11.8 in)

Weights: overall 125.7 kg (277 lb); propellant 15 kg (33.07 lb); explosive 44.66 kg (98.46 lb)

Performance: initial velocity 230 m (754 ft) per second; range about 4550 m (4,975 yards)

JAPAN

Japanese rockets

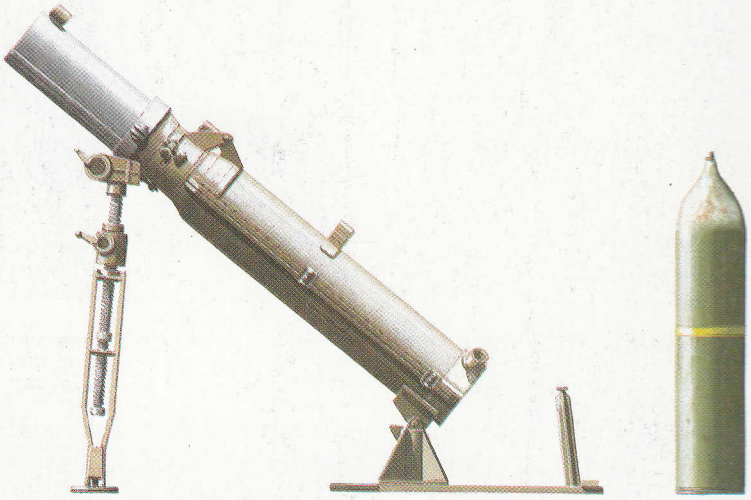
The Japanese recognized the value of the artillery rocket to their under-armed forces and carried out considerable design and development work in order to provide a weapon that could make up for their lack of industrial capacity. Unfortunately for them their results were patchy and well behind the work carried out by the Allies. To add to the lack of Japanese success there were often development programmes carried out in opposition to each other, and typical of these were the projects to develop a 20-cm (7.87-in) rocket by both the army and the navy.

The **Army 20-cm Rocket** may be regarded as the better of the two projects. It was a spin-stabilized rocket using six base vents to impart propulsion and spin, and had an overall resemblance to an artillery projectile. To fire this rocket the army provided what appeared to be an oversize mortar known as the **Type 4 Rocket Launcher**. The rocket was inserted into the 'barrel' by raising part of the upper section of the barrel and part of the tube base was open. This launcher was supposed to deliver the rocket relatively accurately, but few equipments appear to have been issued and most of these were used for coastal defences.

The **Navy 20-cm Rocket** resembled the army weapon in many respects, but was intended for launching from troughs made from simple wooden planks, or in some cases more sophisticated metal troughs. At times the rockets were simply emplaced to be launched directly from holes dug in the ground. A more conventional launcher used in small numbers only was a simple barrel on a light artillery-type carriage.

These 20-cm (7.87-in) rockets formed the bulk of the Japanese rocket programmes but there were others. One was the **Type 10 Rocket Motor** which was a simple propulsion unit designed to push aircraft bombs along ramps or troughs to launch them. At least two versions of the Type 10 existed but they were very inaccurate and had a maximum range of only 1830 m (2,000 yards). The launchers used for these rocket motors were often improvised, and improvisation was also used in at least one case where the conventional fins of an aircraft 250-kg (551-lb) bomb were replaced by a large rocket motor for launching from a simple wooden trough. Some intelligence reports from the period (1945) speak of these launchers mounted on trucks, but no confirmation of these has been found.

The largest of all the Japanese rockets had a diameter of 447 mm (17.6 in), and this **44.7-cm Rocket** was a somewhat crude spin-stabilized design that was used in action on Iwo Jima and Luzon. It had a range of 1958 m (2,140 yards) at best, and was launched from short wooden racks or frames. It was wildly inaccurate, but it did have a warhead weighing 180.7 kg (398 lb).



Japan undertook considerable development work on rockets, but lagged behind the other belligerent nations and produced few usable weapons. This 20-cm army rocket was one of the small number to see action.

By the time these rockets were used Japanese industrial capacity was in such a state that the conventional high explosive warheads for these rockets often had to be replaced by simple picric acid.

Specification

Army 20-cm Rocket

Dimensions: length 984 mm (38.75 in); diameter 202 mm (7.95 in)

Weights: overall 92.6 kg (44.95 lb); propellant not known; filling 16.2 kg (35.7 lb)

Performance: initial velocity not known; range not known

Specification

Navy 20-cm Rocket

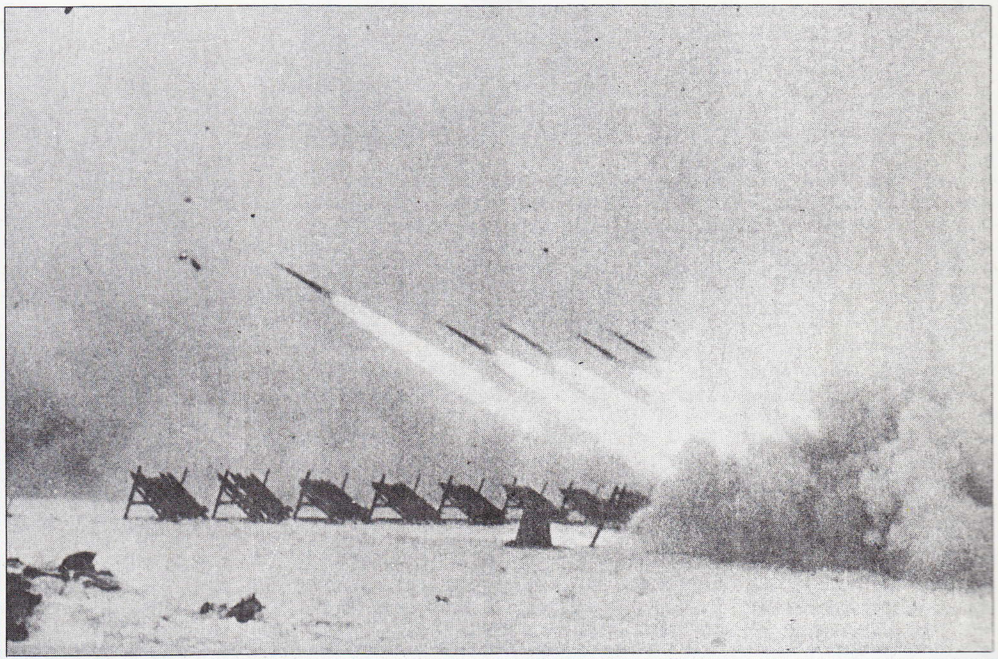
Dimensions: length 1.041 m (41 in); diameter 210 mm (8.27 in)

Weights: overall 90.12 kg (198.5 lb); propellant 8.3 kg (18.3 lb); filling 17.52 kg (38.6 lb)

Performance: initial velocity not known; range 1800 m (1,970 yards)

Red Army Rocket: Katyusha

From the darkest days of 1941 to the triumphant battle for Berlin, the Katyushas bolstered the Red Army in its titanic struggle with the Wehrmacht. Since 1945 Katyushas have seen action worldwide.



For the awesome barrages which heralded a Red Army offensive rockets would be massed on static launchers close to the front. Here the first salvoes blast off against the doomed men of the German 6th Army trapped in Stalingrad, January 1943.

When the first Katyushas went into action they were rushed to the front before the Red Army was really ready for them. The initial field units used the M-13 rocket which was a much-modified and lengthened RS-132 rocket intended for aircraft use. Although the M-13 had by 1941 been developed to the point where it worked consistently on test, the production facilities needed to produce it in large numbers were only just being established, so the first rocket battery went into action with what was virtually the entire current stock of launchers and rockets.

Training for the first M-13 battery had been under way since January 1941 but had been slowed by the overall lack of equipment. The instructional staff had suddenly to start training combat crews when the Germans invaded the Soviet Union, and this new battery had only four days of tuition before it set off for the front. With the new battery went seven BM-13-16 launchers, the entire stock of M-13 rockets (about 600 in all), 44 scarce cargo trucks to carry the equipment and ammunition, and a single 122-mm (4.8-in) howitzer for ranging purposes. This battery was heavily indoctrinated with the need for secrecy regarding its novel weapons. The launchers were kept covered right until they were in action and the crews were culled mainly from dedicated party members to ensure overall security.

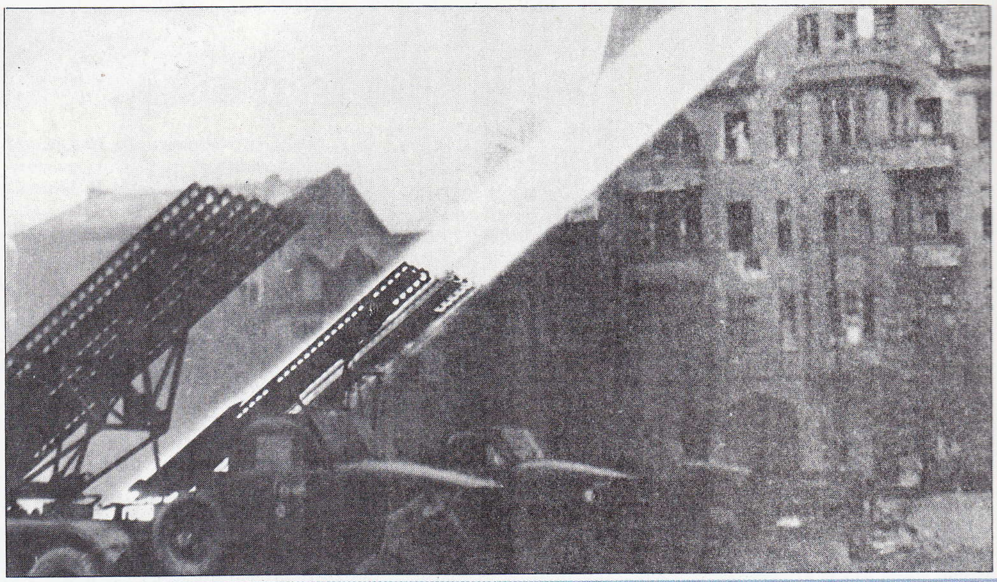
This first battery went into action on 7 July 1941, and was used to attack an advancing German troop concentration in a bend of the River Berezina on the Smolensk front. The sudden deluge of rocket fire caused panic among the German troops, who were the first to experience the sudden deluge of high explosive coupled with fragmentation warheads that scattered steel fragments over a wide area. The rockets all arrived on their targets in a very short space of time (measurable in seconds) and with their arrival came the scream and whine of the rockets as they fell. This sound was to make the Soviet rockets among the most feared of all weapons, and the noise was enough to demoralize even the most combat-hardened soldiers.

Following the success of its initial rocket attack the battery was in action again a few days later, this time attacking a railway junction at Orsha. Thereafter the battery was constantly in action, although at times limited by the supply of rockets, but all the time the Germans were pressing forward all along the front and by October the first rocket battery was surrounded and lost. The rocket troops destroyed their equipment before the advancing Germans could seize their prizes.

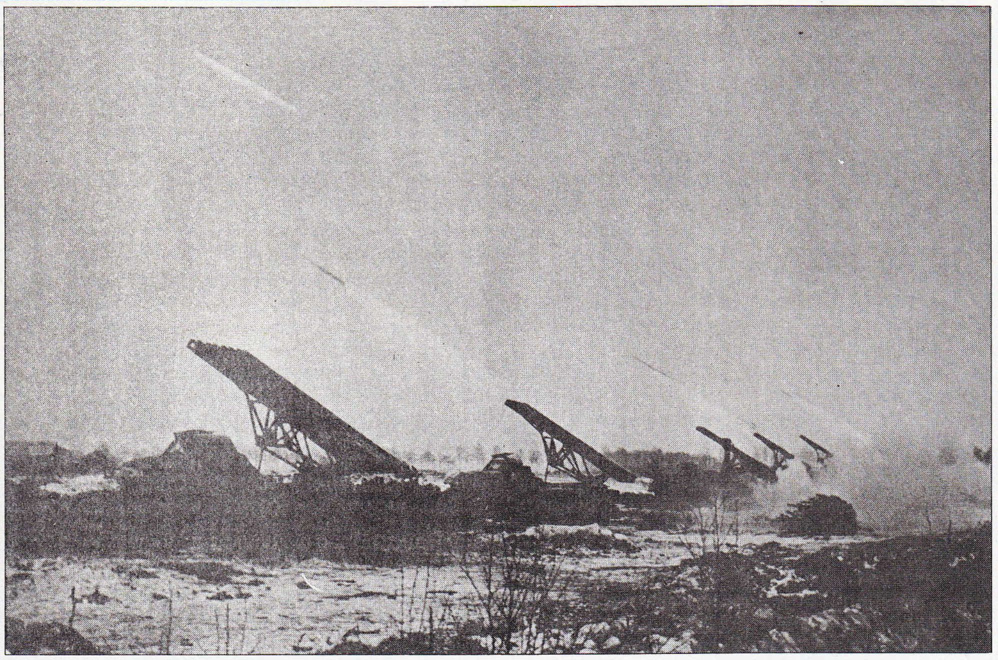
But by that time the rocket troops had made their mark. The staff officers of the Soviet 20th Army, in whose area the first battery had been operating, made very favourable reports and it was therefore decided that mass production of the M-13 and BM-13 should go ahead as soon as possible. At the time this was difficult as much of the Soviet Union's industrial capacity was either in German hands or in the process of being moved east beyond the Urals, but by September 1941 the Red Army had established a new command structure to oversee the production and employment of the new weapon. This new command used all its powers to rush the rocket weapon into the field, and Soviet war workers had to endure the most desperate privations in half-completed factories throughout the winter of 1941-2 in order to manufacture the rockets and launchers.

It was in this period that the relative simplicity of the M-13 and M-8 rocket and launcher design enabled the Soviets to churn out the required numbers. At a point early in the design and development stage of the rocket a decision had been made to produce designs with fin stabilization. These were much easier to produce than the spin-stabilized rocket designs favoured later by the Germans, and for the Soviets the decision paid off during those early days of their 'Great Patriotic War'. Rockets and launchers began to flow from the hastily-assembled factories, and by early 1942 were in the field in appreciable numbers.

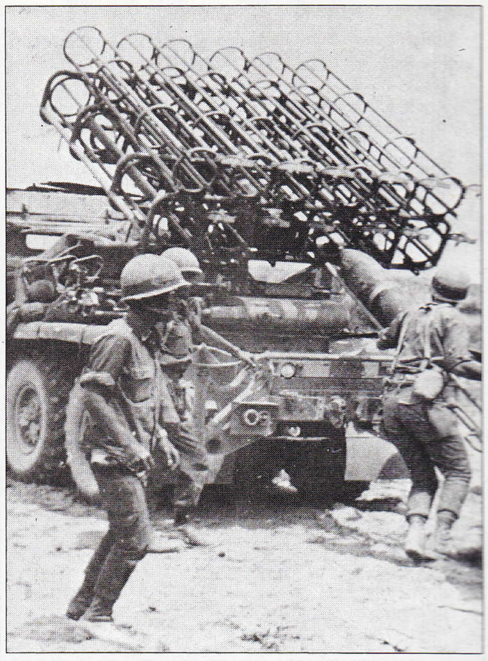
The troops had at first to call their new charges Kostikov guns to hide their true nature, but the soldiers soon found their own name. The rockets and launchers became known as Katyusha (little Katy) after a popular tune of the time. The name stuck and was later used for all the various Soviet war rockets and launchers, although the official term later adopted was Guards Mortar.



In at the kill: steel shutters down, Katyushas bombard the last pocket of German resistance near the Reichstag itself in March 1945. Such was the power of the Soviet industry that by 1945 some 10,000 launchers had been produced along with over 12 million rockets.



M-13 132-mm rocket launchers in action on the outskirts of Berlin. The dreadful noise and clouds of smoke produced by rockets, combined with the shock effect of mass detonations, frequently induced panic amongst the defenders.



Original World War II Katyushas and their modern launchers are favourites of the Palestine Liberation Organization. Also, after the Israelis crushed the PLO in Beirut in 1982 they captured many Katyushas, which they now use themselves.

The M-13 rockets were soon joined by the M-8 and later by the M-30 and M-31, but these were not the only war rockets used by the Red Army during World War II. At one point during the siege of Leningrad the besieged population produced a close copy of the German 28-cm (11-in) rocket known as the M-28, but this was a local expedient only and the M-28 was little used once the siege had been lifted. Then there was the M-20 which was essentially a stretched M-13 with a much larger explosive content and double the fuel but a reduced range, and to add to this they were so long that they could be fired from the upper rails only of the BM-13 launcher. By late 1944 the M-20 had faded from the scene. There were many experimental models. A 203-mm (8-in) rocket was at one point the subject of trials that came to nothing, and at another time a 120-mm (4.72-in) rocket seemed promising but then faded from view.

But by 1945 the basic rockets in use were the M-8, M-13 (in several forms) and the M-31. After 1945 the M-8 and M-31 passed from service with the Red Army, but many were passed to friendly or occupied states and thus turned up from time to time over the troubled decade following 1945. Katyushas were used in action in Korea by the Chinese, who took to the weapon with a will. They produced Katyushas as fast as they could but it is doubtful that they managed to exceed the Soviets' output up till 1945: estimates put the latter's final total at well over 10,000 launchers and well over 12 million rockets of all kinds. At one point no less than 200 factories were producing components for the Katyushas, and Katyushas were used not only by the Red Army but also by the Soviet navy to arm light coastal and river craft. More Katyushas were mounted on armoured trains.

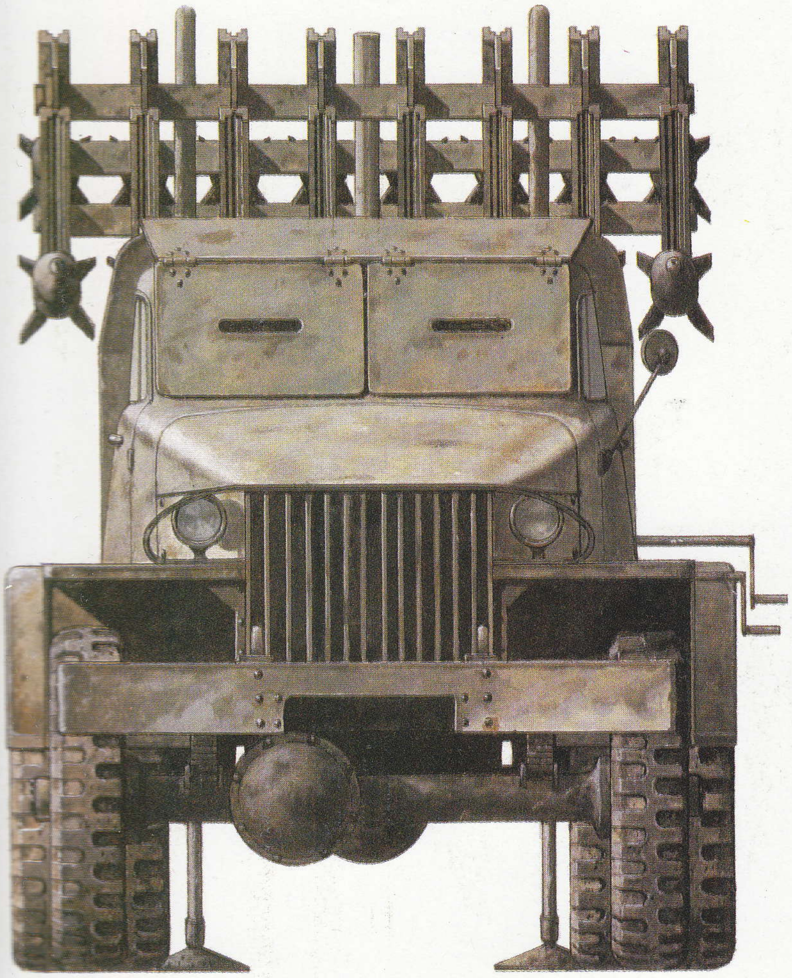
When the war ended the Red Army had well over 500 Katyusha batteries, and their numbers were not then reduced to any great extent. Instead they were updated and new types came into use. The Lend-Lease truck carriers were replaced by new Soviet models.

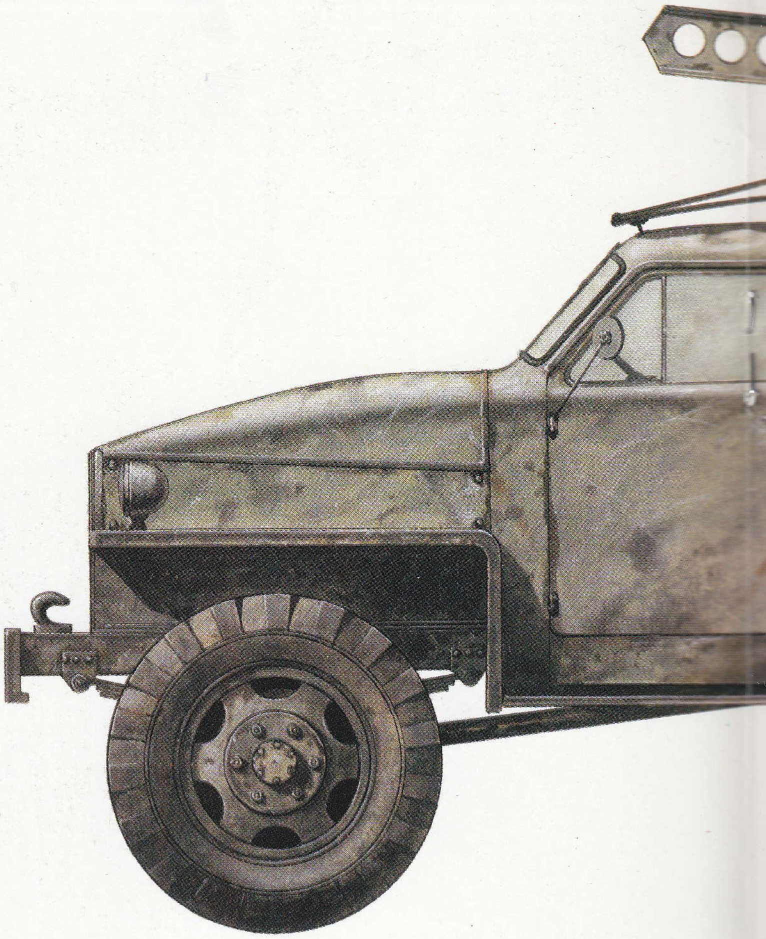
The M-13 rocket remained in service with the Red Army until the 1980s, but by then new rockets were in service. During the late 1940s and early 1950s new designs including 140-mm (5.5-in), 200-mm (7.87-in), 240-mm (9.45-in) and 250-mm (9.84-in) rockets were developed. The main change with these new designs was that with the urgency of invasion behind them the Soviet designers could divert their attentions to spin-stabilized designs. All the new rockets used such stabilization with the exception of the 250-mm (9.84-in) M-25, which has fins for at least some stability and also differed from the others in using a liquid propellant in place of the normal solid motor. The M-25 is now in very limited use, and indeed may already have passed from the military scene.

These rockets are still in service although their theatre has now generally shifted away from the Soviet Union to Soviet satellites and client states. In some cases the very type of use has altered also: originally the Katyushas were designed as artillery rockets, but with the growth of 'liberation armies' and other types of guerrilla or terrorist formations the rocket has taken on a new role. Underground movements soon learned that a Katyusha rocket of whatever calibre had an effect quite out of proportion to its size and weight when used on an individual basis against selected targets. Thus special launchers for single rockets became commonplace and are now used all over the world.

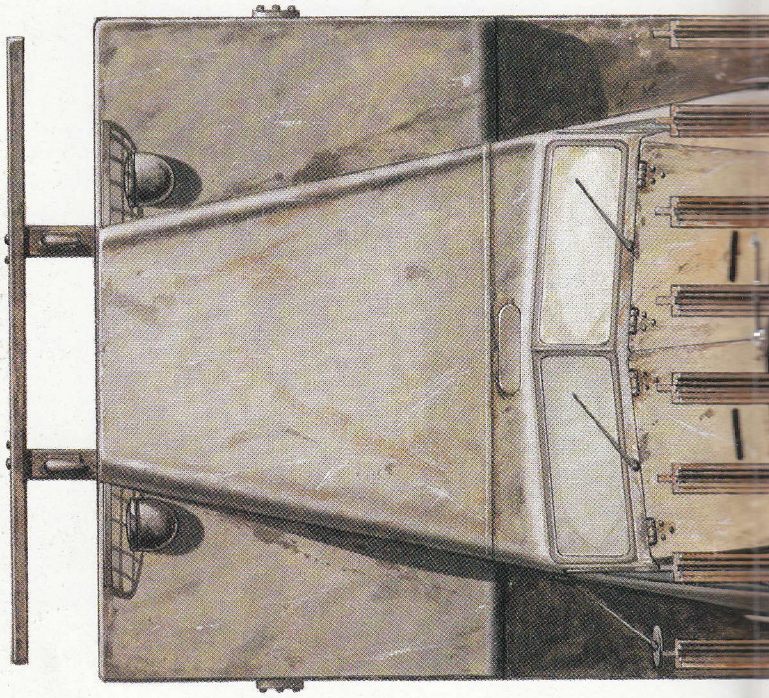
In two particular locations the sounds of single Katyusha rockets being fired against selected targets became commonplace namely in Vietnam and the border country of Israel. In Vietnam two new types of rocket were pressed into action in this role: the 122-mm (4.8-in) and 140-mm (5.5-in) weapons. The 122-mm (4.8-in) rocket was first introduced into Red Army service during the 1960s, but it was not long before a single-barrel launcher was produced specifically for guerrilla and special unit service. This rather complex launcher was frequently encountered in Vietnam, as was a much cruder launcher for the 140-mm (5.5-in) rocket. The latter was nothing more than a tube secured to a plank and placed on the ground for firing. Both launchers could be carried by a single man, with another carrying the rocket.

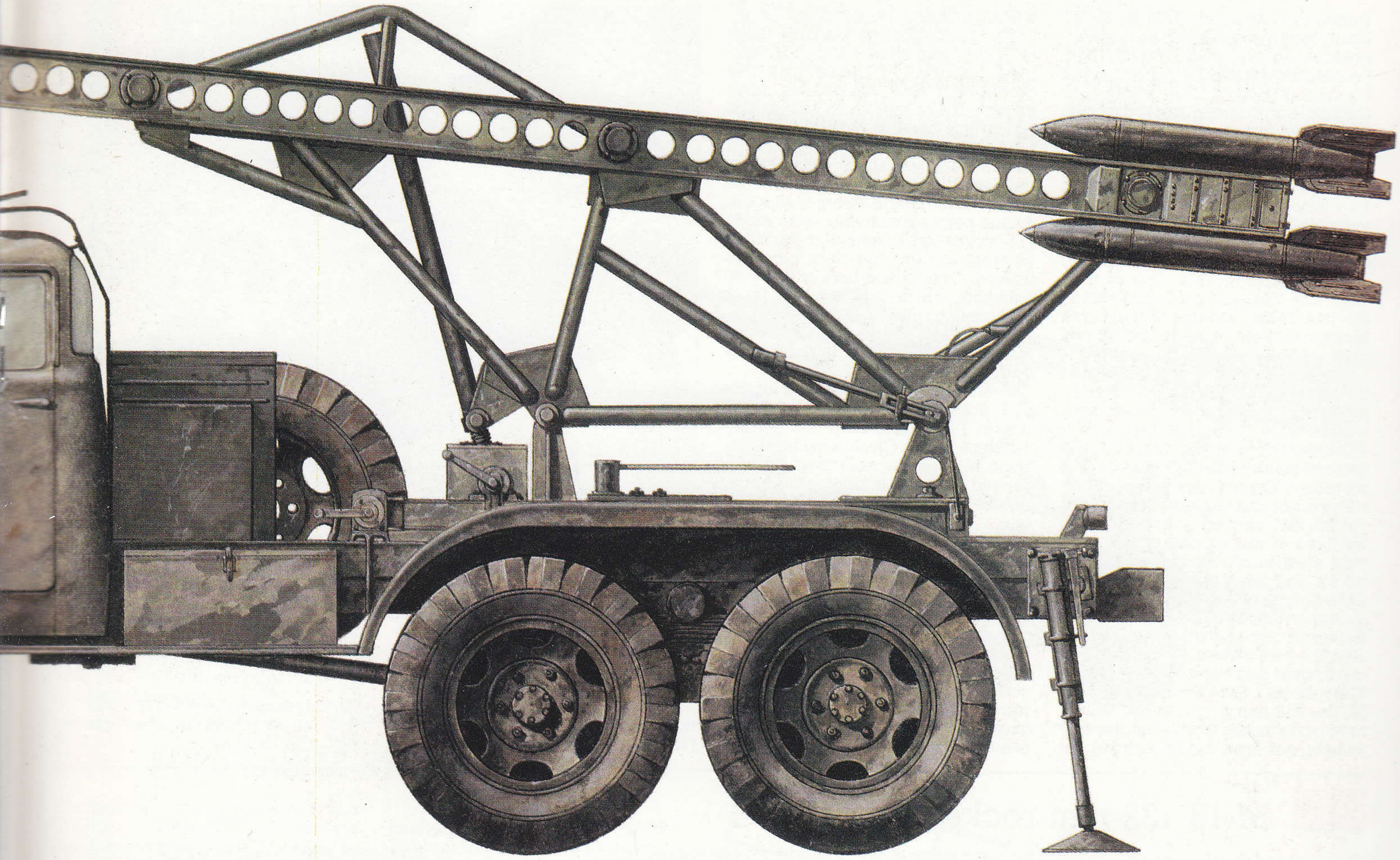
A similar arrangement has been encountered in the Middle East around the borders of Israel, but there the rocket involved has usually been the M-13 using a locally-produced launcher. This results from the fact that the BM-13-16 has been widely handed out by the Soviet Union to many armed forces in the area, and some of these have been passed to the Palestine Liberation Organization (PLO). From its early days as a guerrilla organization, the PLO had by the early 1980s developed to the point where it resembled a conventional army complete with BM-13s, which frequently travelled to the Israeli border to let off a salvo before retreating hurriedly, so making the border areas dangerous places to live and work. Single launchers carried by small bands added to the danger. It was these rocket attacks that often prompted Israeli raids in neighbouring territories, culminating in the invasion of Lebanon in 1982. Then the Israelis advanced right to the outskirts of Beirut where the PLO attempted to fight a conventional campaign against the Israeli army. Among the PLO's armoury were Katyushas, usually BM-13s but with some 140-mm (5.5-in) multiple launchers, firing from built-up and populated parts of Beirut to prevent the Israeli use of counterbattery fire. Despite all their efforts, the PLO was soundly beaten and forced to leave Beirut, its power base for many years. The Katyushas fell into Israeli hands, and now form part of the Israeli arsenal. So their day is not yet over, and it will be many years before their power and noise finally fade from the battlefields of the world.

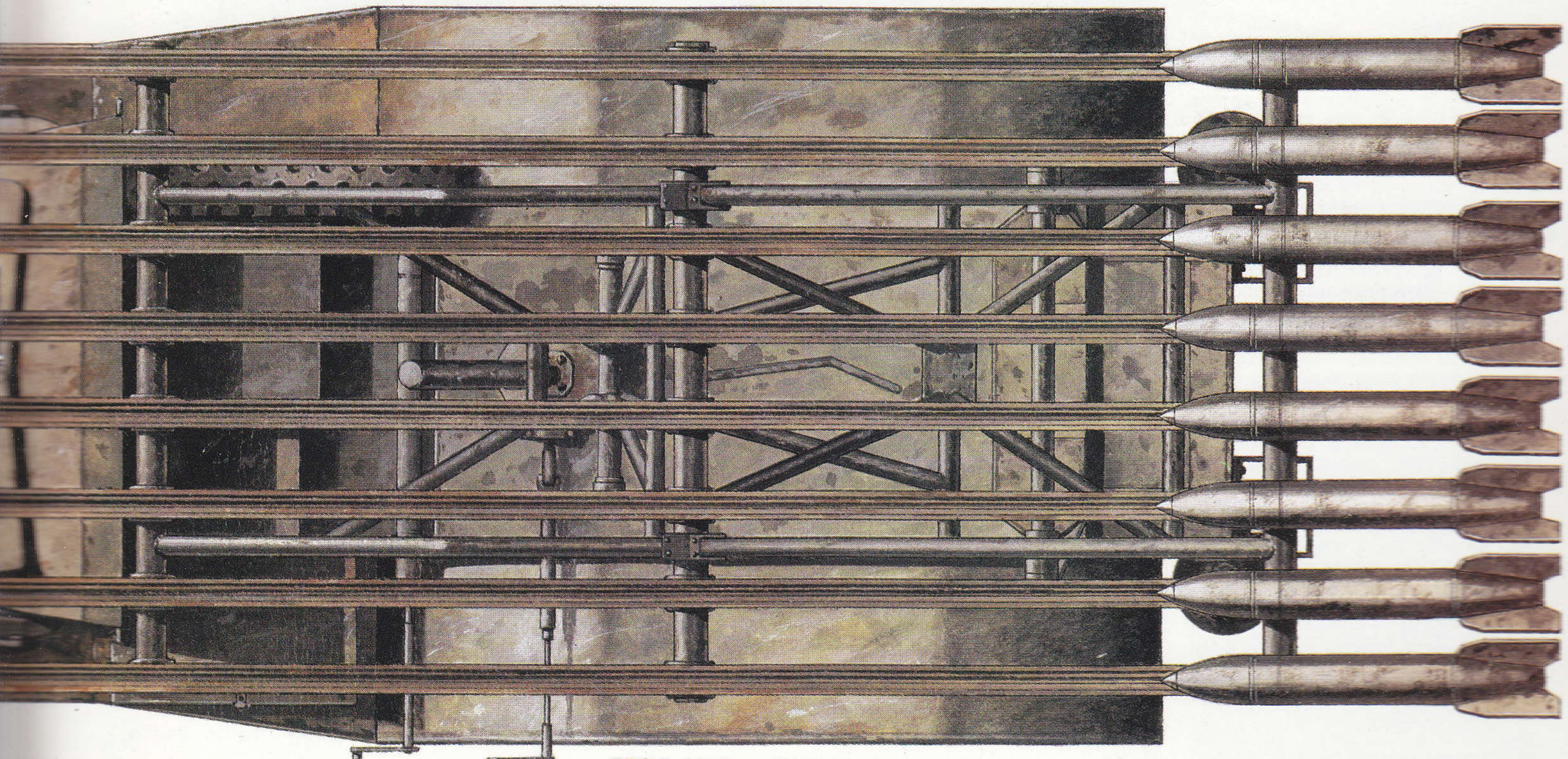




Introduced in conditions of great secrecy and crewed by dedicated party members, the first Soviet rocket launchers were tested in combat on 7 July 1941. Called Kostikov guns to conceal their real nature, they were soon nicknamed 'Katyusha' (little Katy) after a popular song of the time. Rockets were mounted on a wide variety of vehicles from obsolescent light tanks to ZiS-6 lorries, but one of the most common combinations was the M-13 132-mm rocket on American Studebaker 6×6 trucks. Note the steel shutters over the windscreen to protect the cab from the ferocious backblast.






PETER SARSON- TONY BRYAN.

USSR

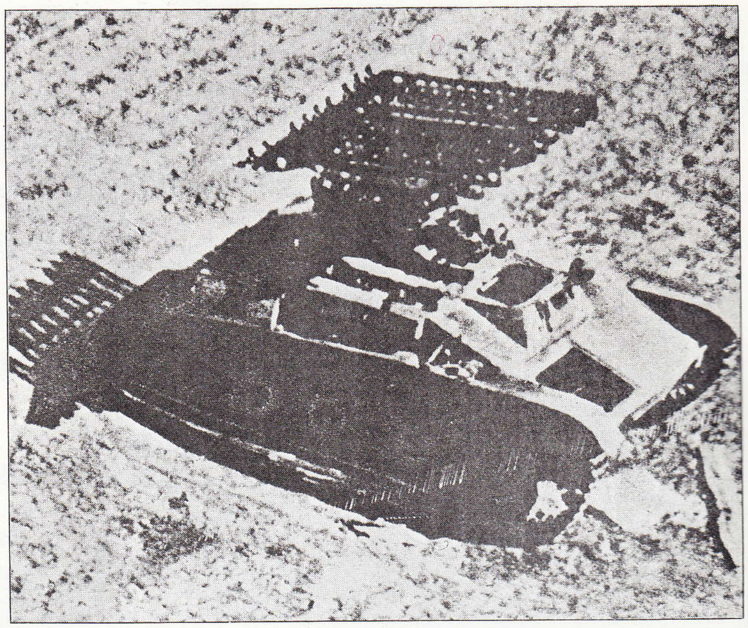
M-8 82-mm rocket

During the 1920s and 1930s the Soviet Union used a great deal of its research potential to determine exactly how propellants suitable for rockets could be mass produced. Even before 1918 the Russians had been great advocates of the war rocket, and after this the Soviets were determined to remain in the forefront of rocket technology despite the fact that they were hampered by a lack of industrial potential, which in turn led to their selection of the simpler and more easily produced fin-stabilized over the more accurate spin-stabilized rockets. One of their very first designs, produced during the late 1930s, was one of their most famous rockets, namely the 82-mm (3.23-in) **M-8**.

The M-8 rocket was an off-shoot of an aircraft rocket programme. The aircraft rocket was the RS-82, and such was the state of the Soviet rocket development programme that it actually entered service after the 132-mm (5.2-in) rocket. The M-8 was a small rocket with a maximum range of 5900 m (6,455 yards) that carried a fragmentation warhead. It was carried on and fired from a series of rails carried on 6×6 trucks, and these rail launchers were just one type of the series of weapons known as **Katyusha**. One of the first of these multiple launchers was carried on a ZiS-6 6×6 truck. As this arrangement could carry and launch up to 36 M-8 rockets it was known as the **BM-8-36**, the BM denoting 'combat vehicle' as a cover name. It was not the only vehicle that fired the M-8 rocket, for when sufficient US-supplied Lend-Lease trucks became available these too were used as M-8 launcher vehicles: typical of these was the Studebaker 6×6, which was large enough to take rails for 48 rockets and which thus became the **BM-8-48**. But being wheeled, these launchers could not always traverse the rough terrain of the Soviet Union or keep up with the tank units they were meant to support. At one point experiments were made to fit single-rail launchers to the sides of tank turrets, but they came to nothing. Instead numbers of the T-60 light tank, which had proved to be of little combat value in its designed role, were converted to take rails for 24 M-8 rockets and the type thus became known as the **BM-8-24**.

There were other launchers for the M-8 rocket, including a special eight-rocket frame intended for use by mountain troops. On all of the M-8 launchers the rockets were fired not in a massed salvo but in ripples under the control of an electrical rotary switch box.

The M-8 rockets had quite an effect on the recipient German troops who had to endure the high fragmentation warheads fired into them in large numbers. The Waffen SS was so impressed that it decided to copy the design direct (along with the launcher rails) as its own 'Himmlerorgel'. The M-8 rockets remained in service throughout the war, but following 1945 was gradually phased from use in favour of the heavier Soviet war rockets and in particular the 132-mm (5.2-in) and 310-mm (12.2-in) rockets.



Seen here mounted atop a T-70 light tank, the M-8 82-mm rocket had its origins in an aircraft rocket programme; it proved an enormous success and served throughout the war. The Waffen SS were so impressed that they copied it.

Specification
M-8
Dimensions: length 660 mm (26 in); body diameter 82 mm (3.23 in)
Weights: overall 8 kg (17.6 lb); propellant 1.2 kg (2.645 lb); explosive 0.5 kg (1.1 lb)
Performance: initial velocity 315 m (1,033 ft) per second; maximum range 5900 m (6,450 yards)

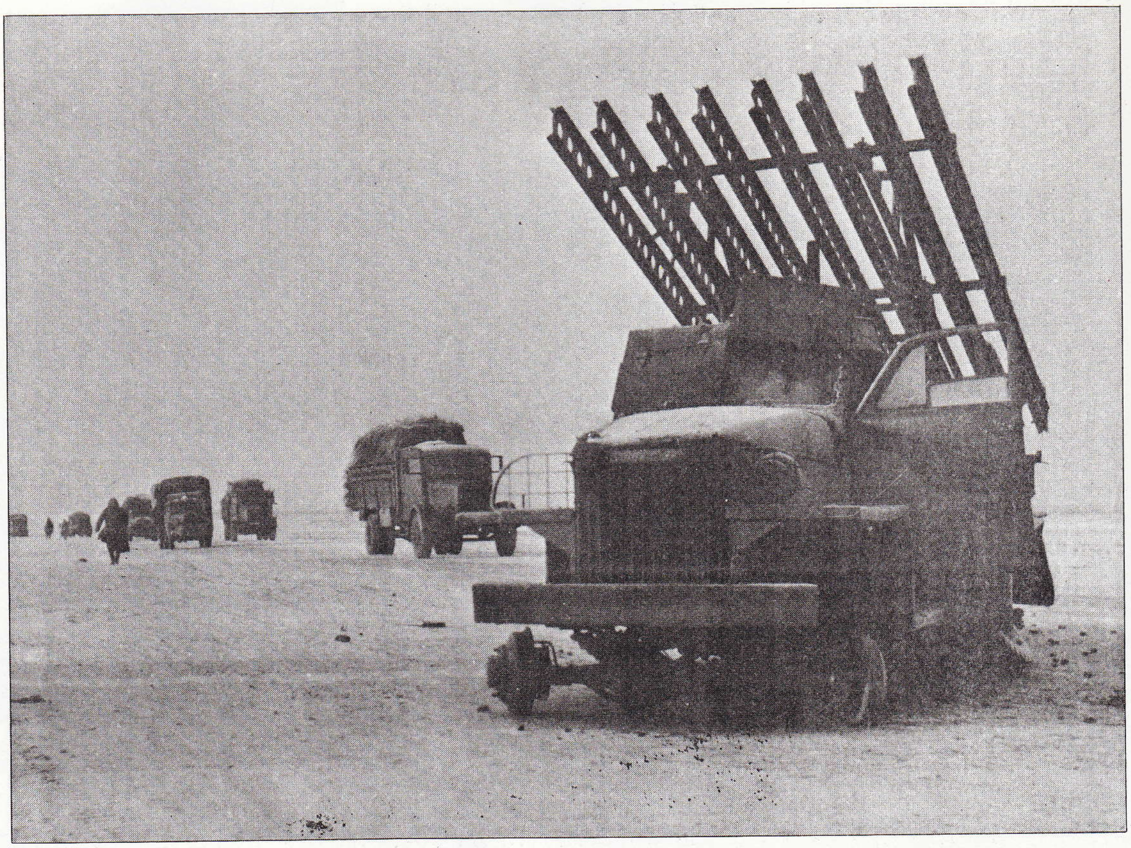
USSR

M-13 132-mm rocket

The most widely used of all the Soviet war rockets during World War II was the **M-13** 132-mm (5.2-in) weapon. It was designed during the late 1930s, and when the Germans invaded the Soviet Union in 1941 there were only a few production launchers and a small stock of rockets to hand. These were pressed into service as an emergency measure and first went into action on the Smolensk front in July 1941, when they caused near-panic among the hapless German troops. This is hardly surprising, for in a period of under 10 seconds a single M-13 battery could swamp a large area in high explosive to an extent hitherto unseen in warfare.

These first M-13 batteries were very much special units. The launchers for the M-13 fin-stabilized rockets were carried by ZiS-6 6×6 trucks with rails for 16 rockets. The rails were known as 'Flute' launchers to the Soviet troops as a result of their perforated appearance, but they soon gained the name Katyusha, and at one time were known as 'Kostikov guns' after their supposed designer. For security purposes the launchers were usually shrouded in tarpaulins when not in use, and the crews were culled from Communist party members in order to maintain tight security. But it was not long before the M-13 launchers were in widespread use and their secrets became common knowledge.

The basic M-13 rocket had a range of about 8000 to 8500 m (8,750 to 9,295 yards). The usual warhead was of the HE fragmentation type, and as always with fin-stabilized rockets accuracy was not of a high order. But as the M-13s were usually used in massed



Shunted off the road and abandoned, this is the most famous of the war rockets: the truck-mounted Katyusha. Because of the distinctive moaning sound the missiles made in flight, the Germans dubbed the weapon 'Stalin's organ'.

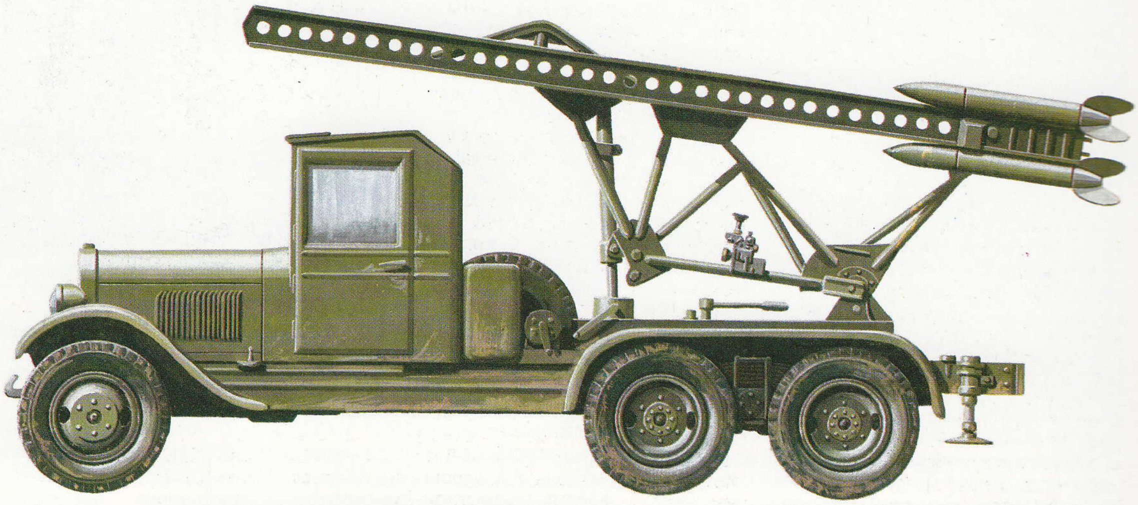
barrages this last mattered only little. Later versions of the M-13 used a form of efflux diversion to introduce more spin for increased accuracy, but this measure reduced the range slightly.

As mentioned above, the first launcher type used 16 rails and was known as the **BM-13-16**, but when supplies of Lend-Lease trucks became available they too were used as Katyusha carriers. Several types of truck, including Studebakers, Fords, Chevrolets and Internationals were so used, along with STZ-5 artillery tractors and other vehicles. These BM-13-16 launchers had no traverse and only limited elevation, and were laid by pointing the carrier vehicle towards the target. Some carrier vehicles used steel shutters to protect the cab and crew during the launching sequence.

As the war progressed more types of M-13 warhead were introduced, including armour-piercing to break up tank formations, flare for night illumination, incendiary and signal. One variation was the **M-13-DD**, which used two rocket motors burning together at launch to produce a possible range of 11800 m (12,905 yards), and this rocket was launched from the upper rails of the launcher only. The M-13-DD had the greatest range of all solid-propellant artillery rockets in World War II.

After 1945 the M-13 rocket batteries remained in Red Army use right up to 1980, when they were finally replaced by later models. The M-13 is still in service with many countries, although modern trucks are now used as carriers in place of the old war-time models. In fact the development life of the basic M-13 is still not over, for the Chinese are now using the rocket as a form of minelet-laying device known as the **Type 74**.

Specification
M-13
Dimensions: length 1.41 m (55.9 in); body diameter 132 mm (5.2 in)
Weights: overall 42.5 kg (93.7 lb); propellant 7.2 kg (15.87 lb); explosive 4.9 kg (10.8 lb)
Performance: initial velocity 355 m (1,165 ft) per second; range 8500 m (9,295 yards)

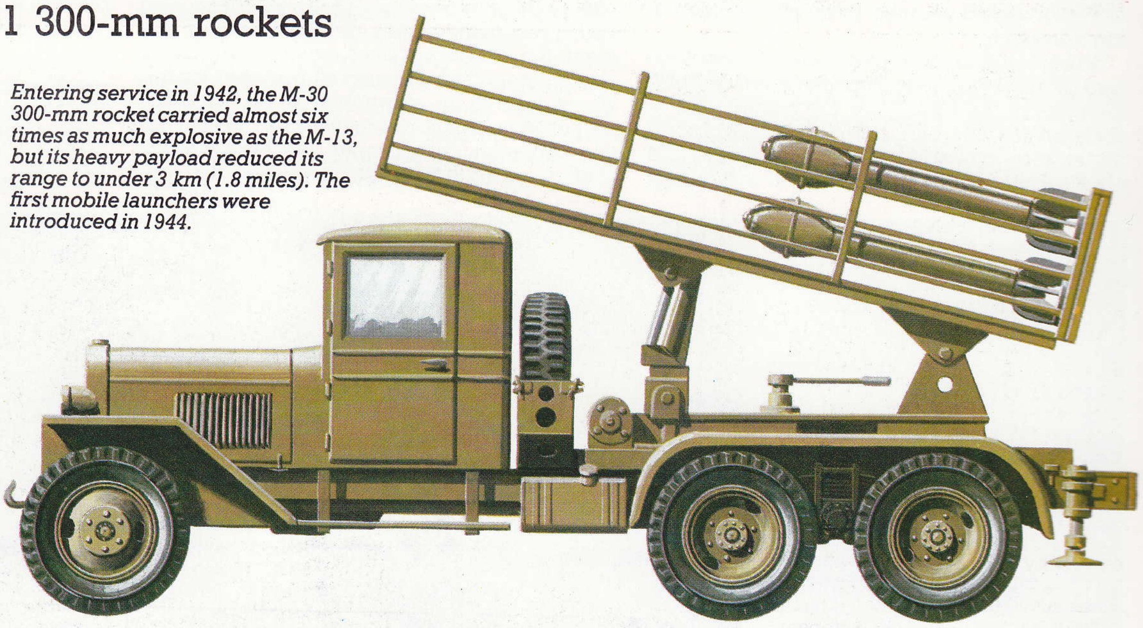


The most widely used rocket of the war, the Russian M-13 132-mm weapon came as a disagreeable surprise to German troops on the Smolensk front in July 1941. It continued to serve in the Red Army until 1980 and still equips several Russian allies today.

USSR

M-30 and M-31 300-mm rockets

The **M-30** 300-mm (11.8-in) rocket was introduced during 1942 when it was appreciated that good as the M-8 and M-13 rockets were, a heavier explosive warhead would be an advantage. The M-30 used a modified M-13 rocket motor allied to a bulbous warhead which contained 28.9 kg (63.7 lb) of explosive, which more than met the requirement though the range was limited to no more than 2800 m (3,060 yards). The first M-30s were fired from their carrying crates with the aid of a frame known as **Rama**, which was a close copy of the German method of using the Packkiste for launching from the schwere Wurfgerät. These Ramas were cumbersome devices that were laborious to set up close to the front line, and were little liked by the Red Army troops. But they did like the M-30 rocket for its powerful effects, even going to the extent of using the M-30 for ambushes against tanks or for house-to-house fighting. When used in this role the M-30 was simply aimed at the target while still in its carrying crate and fired at very close range.



Entering service in 1942, the M-30 300-mm rocket carried almost six times as much explosive as the M-13, but its heavy payload reduced its range to under 3 km (1.8 miles). The first mobile launchers were introduced in 1944.

By the end of 1942 a newer type of 300-mm (11.8-in) rocket was ready and this was known as the **M-31** to differentiate it from the earlier model. The M-31 had an improved rocket motor that gave a range of 4300 m (4,705 yards). This rocket could be fired from the Rama frames in the same manner as the M-30, but later Ramas could take six M-31s or M-30s in place of the original four. By March 1944 the first mobile launchers for the M-31 appeared. These could carry up to 12 M-31s (the short range of the M-30 ruled out their use with the mobile launchers), and the type was thus known as the **BM-31-12**. Early versions of this launcher were carried by the ZiS-6 6×6 truck, but most wartime production examples were carried on Lend-Lease Studebaker US-6 6×6 trucks. These American trucks were fitted with steel shutters over the cab windows for protection against blast when the rockets were fired.

After 1945 the M-31 rockets did not survive for many years as they were essentially short-range weapons, and as such often suffered from counterbattery fire. But the basic M-31 did undergo some developmenmt before it was dropped. There was an **M-31-UK** which used some of the efflux gases to impart a measure of spin for increased stabilization and hence accuracy. Range was slightly reduced, but the M-13-UK could greatly decrease the area of ground covered by a battery and thus increase the amount of explosive falling upon a point target.

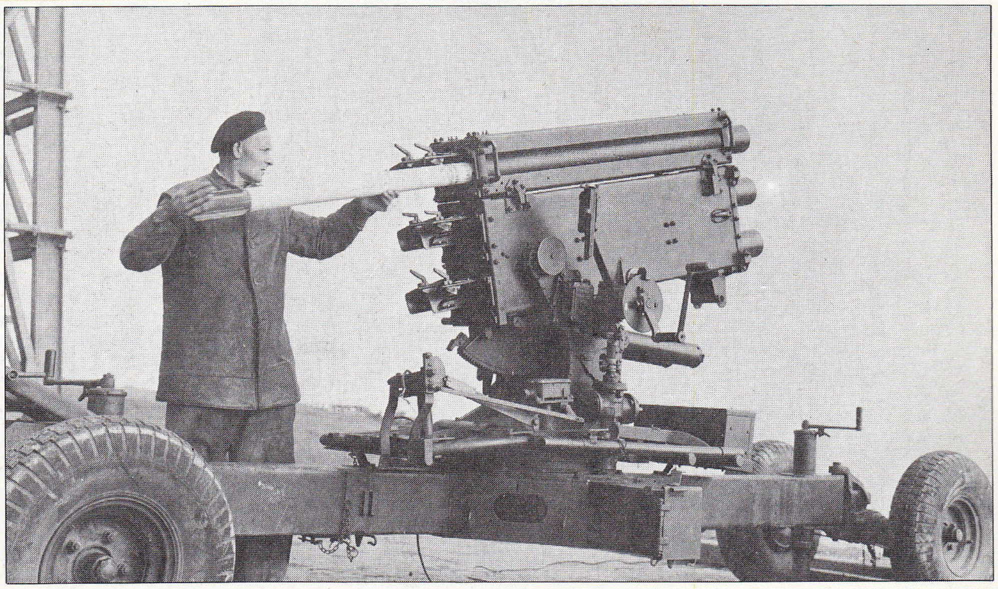
The M-30 and M-31 rockets were fitted only with HE warheads. They were undoubtedly powerful projectiles, but they lacked range and for much of the war their mobility was virtually nonexistent as they had to be fired from the static Rama frames. It was not until the later stages of the war that they were provided with mobility in the form of the BM-31-12, a tardiness for which the German troops on the Eastern Front were no doubt grateful.

Specification
M-30
Dimensions: length 1.20 m (47.24 in); body diameter 300 mm (11.8 in)
Weights: overall 72 kg (158.7 lb); propellant 7.2 kg (15.87 lb); explosive 28.9 kg (63.7 lb)
Performance: initial velocity not known

Specification
M-31
Dimensions: length 1.76 m (69.3 in); body diameter 300 mm (11.8 in)
Weights: overall 91.5 kg (201.7 lb); propellant 11.2 kg (24.7 kg); explosive 28.9 kg (63.7 lb)
Performance: initial velocity 255 m (836 ft) per second

Rockets of the West

Britain had been the first Western nation to use rockets in action; Congreve rockets helped burn Washington in 1812, but the introduction of modern rockets into British Army service took a long time. But despite starting from scratch the Americans produced the best Allied rocket, the M8.



The original stimulus to British pre-war rocket design had been the need to develop an anti-aircraft weapon. Although the AA rocket proved unsuccessful it was used as the basis for some interesting designs, like this 24-pdr air-portable rocket projector.

The first nation among the Allies of World War II to devote attention to war rockets was the UK. During the 1930s the staff planners of Whitehall appreciated that the national armoury had fallen to the point at which the nation was wide open to air attack. The production of adequate numbers of anti-aircraft guns would be expensive to an extreme in the foreseen time scale (which turned out to be much shorter than expected at that time), so it was reasoned that the rocket might fill the gap to some extent.

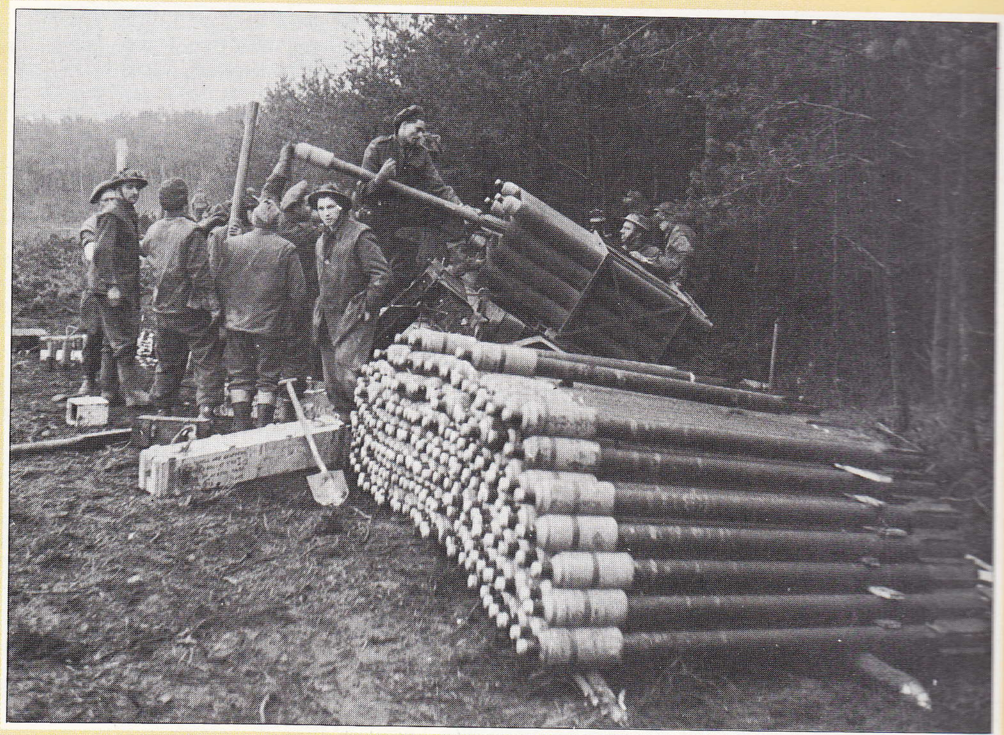
Thus British scientists started a programme that was to last throughout the war years. Starting virtually from scratch and having only the technology derived from the old black-powder Congreve and similar designs of the previous century, they soon established some basic principles. One was that the use of new propellants based on extruded grains of cellulose-based compounds was a viable proposition, and the ability to produce such a propellant on a large scale was established. By a series of trials and errors they learned the hard way what could and could not be achieved by rockets using the new propellants, and at times the negative aspect seemed to be all too much in the ascendant.

Together with the rocket research went research into launchers. This was much simpler than that of the rocket, for the classic form of rocket launcher had been well established many decades earlier with the Congreve and Hale rockets. The rocket required only a simple frame or rail system for launching, and as mass production was the ultimate objective the simpler the design the better. That is exactly what emerged. At the time two rockets were under development consideration, namely 51-mm (2-in) and 76.2-mm (3-in) weapons, and both used very simple rail launchers. In the event the 76.2-mm rocket proved more useful and the intended anti-aircraft launcher for this was simple to an extreme. The first 76.2-mm rocket launcher, sometimes known as the Harvey projector, was simply two rails 3.658 m (144 in) in length with light metal sheets to protect the crew from blast at the moment of firing. These simple projectors were used in large batteries all placed close together and fired at the same instant, which was the only way that a target could be usefully engaged as for simplicity's sake the British rockets used fin stabilization and were thus inherently inaccurate.

The only Western weapon used in comparable numbers to the Katyusha was the American M8 4.5-in weapon, seen here in action in the Hurtgen forest, Germany, in November 1944. The gunners are re-loading, surrounded by the smoke of the last volley.

As the rockets left the launcher rails any slight influence on their path from side winds or other factors made them veer off course, sometimes to an alarming degree. Mass production methods for the rockets introduced more possible variables, and so poor was the overall performance of the first British war rockets that the only way to use them effectively was to fire vast numbers of projectiles at the target. Thus later projectors used a greater number of launcher rails until the ultimate was reached with no less than 20 rockets on a single launcher.

Once the anti-aircraft rocket was in service, it was appreciated that there could be other uses for so simple and relatively inexpensive a weapon. Various applications for the war rocket were undertaken on an experimental basis, including what was perhaps the most bizarre of all, a device known as the Grand Panjandrum. This was a massive twin-wheel arrangement propelled by rocket motors placed around the wheel rims. The idea was that the wheel could be launched from landing craft and allowed to move up a beach to any local defences, where the wheel would be exploded. The idea was sound, but it did not work in practice, despite considerable efforts. A far more successful project was the Hedgehog, which was a cross between a spigot mortar and a rocket and was used to hurl depth charges at submerged submarines. From Hedgehog grew the Hedgerow, which was used to fire racks of bombs at beach defences during the Normandy invasion. Another offshoot of the Hedgehog was the American 183-mm (7.2-in) T37 rocket.

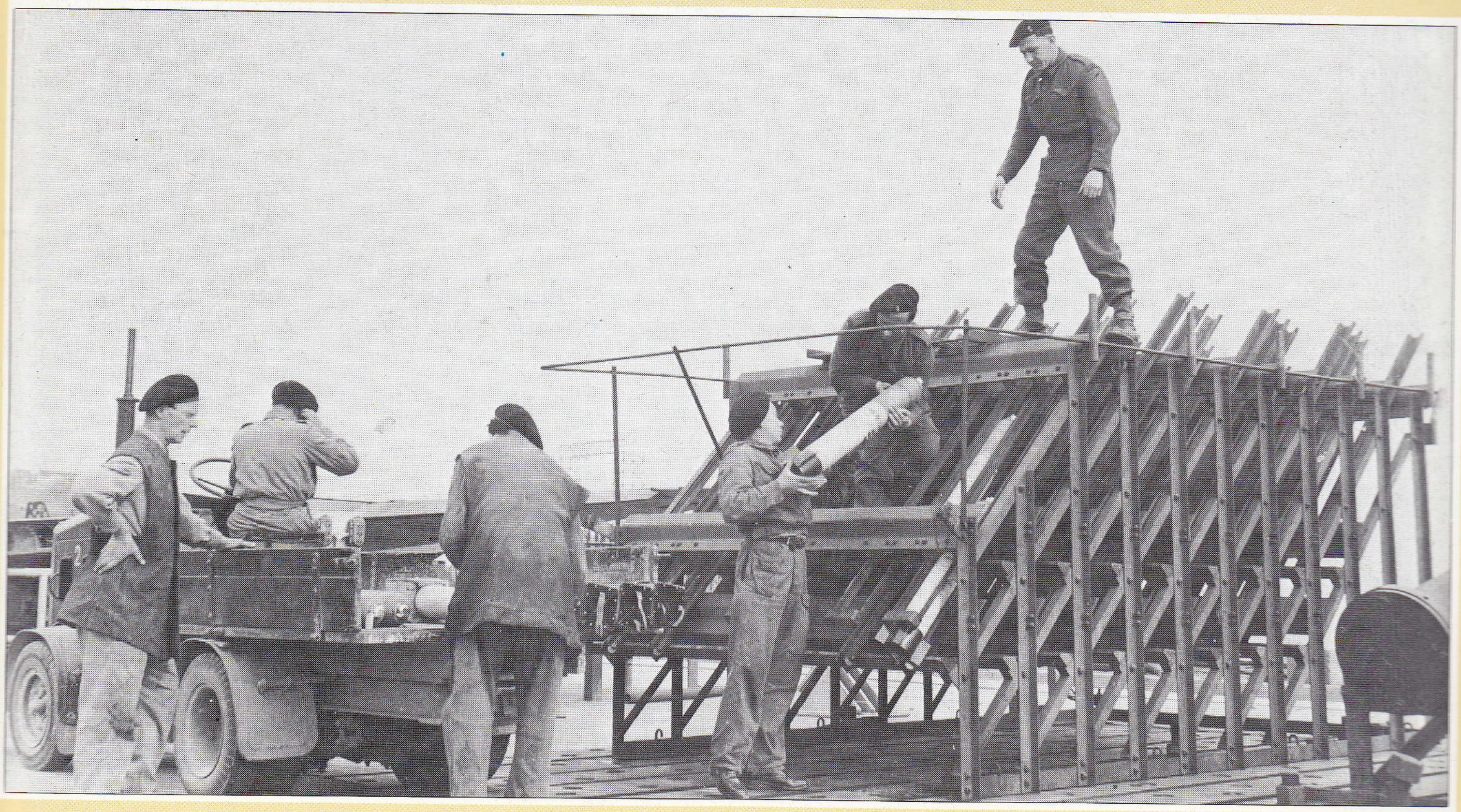


The British Land Mattress system compromised between the expense of the spin-stabilized rocket and the inaccuracy of fin-stabilized designs by using the launcher itself to impart a degree of spin to the projectile.

The air threat

By the time the offshoots from the British rocket programme were under way the Americans were in the war. Starting from nothing they soon built up the entire industrial complex required for rocket production, starting with a propellant factory that was churning out extruded grains of propellants even before it was finished. The main American programme was directed towards producing an all-purpose rocket, although in the event the weapon was used mainly for the artillery role. The Americans concentrated all their efforts on the 114.3-mm (4.5-in) M8 rocket, and they made a good choice. The M8 was produced in far greater

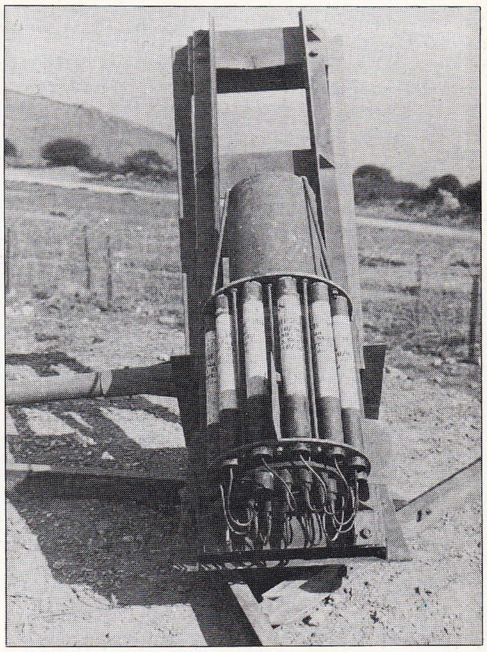
'Stickleback' was a British system to pulverize enemy beach defences. The projector was fixed to landing craft, and launched a hurricane of 5-in rockets, each rated as the equivalent of a 5.5-in howitzer shell. 'Stickleback' could carry up to 72 missiles.



numbers than any other solid-fuel rocket during World War II with the possible exception of the Soviet rockets, for which no precise figures are available. A bewildering array of launchers was developed to fire the M8 rocket. Few of them ever got into the hands of the troops, and the few that did were usually unable to meet the strict safety and other standards normally required by the US forces. Thus many of the M8 projectors retained their 'T' experimental designations although some were used in appreciable numbers. Some were even local or emergency improvisations such as the device known as Scorpion: this was a multiple launcher array that could be fitted into the cargo area of a DUKW amphibious cargo carrier, and could fire up to 144 M8 rockets. It was improvised to meet a local requirement during the invasion of some Japanese-held islands in the Pacific.

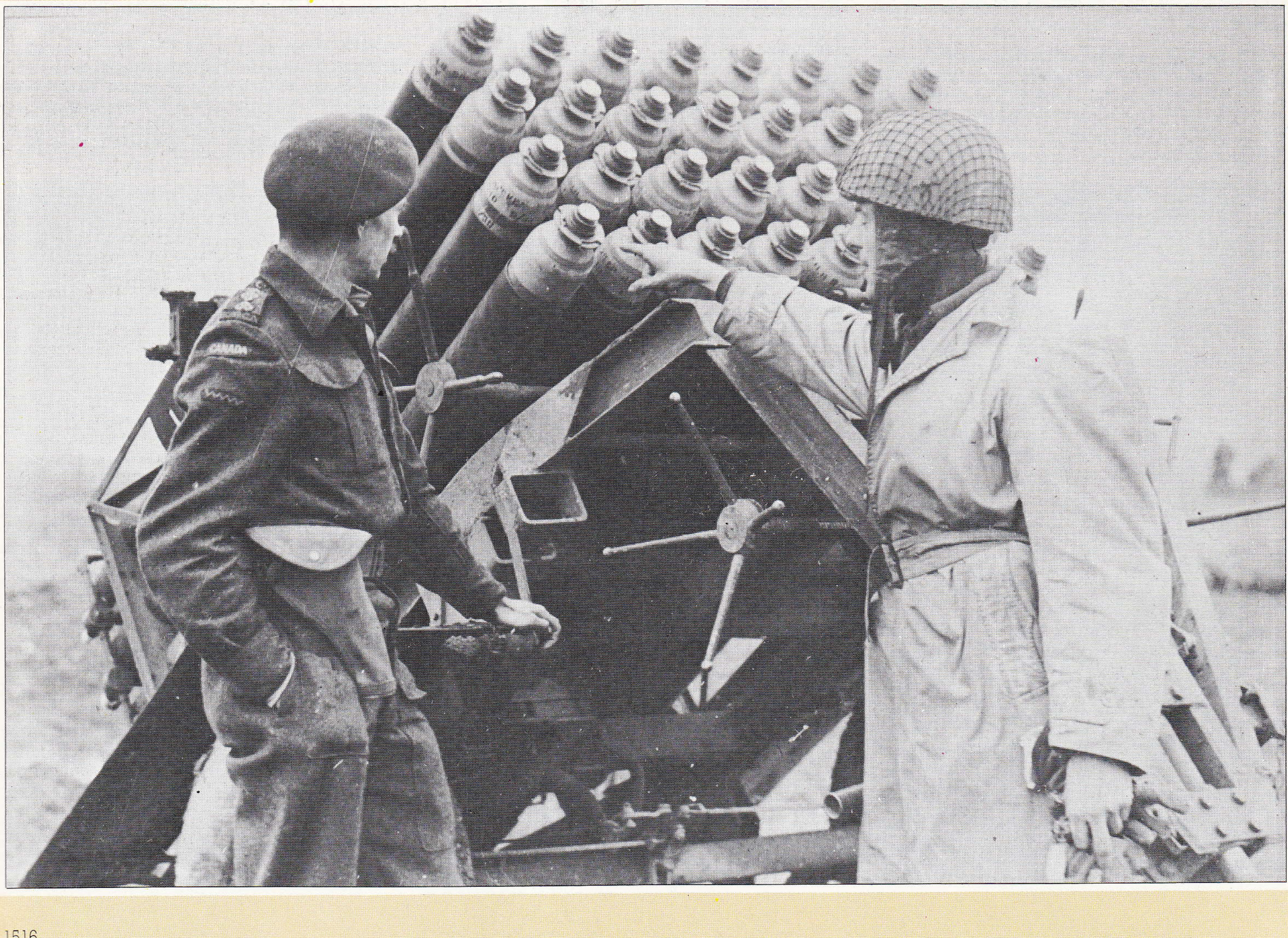
By 1944 the war rocket was already well established as an aircraft weapon, and was used to attack not only land targets but naval targets as well, including submarines. But there was one role that the Allies had yet to explore, and that was the artillery rocket. In their haste to get rockets into production both the British and the Americans plumped for the fin-stabilized rocket to speed production. But such a rocket was primarily an area-saturation weapon, a fact well demonstrated by the Soviet Katyushas, while the main protagonists of the artillery rocket were the Germans, who used spin-stabilized rockets in large numbers. Thus if the Allies wished to counter the German rocket batteries on their own terms, they too had to adopt the spin-stabilized rocket with all the attendant production costs and perhaps even some loss in potential range since this weapon has to use some of its energy to produce the spin.

In typically thorough fashion the Americans set about producing a proper spinner and in time came up with the 114.3-mm (4.5-in) M16 rocket together with its multiple projector, the T66. But producing this combination cost the Americans a great deal of time, and only small numbers saw action before the war ended. The British designers, with less production potential than the Americans, attempted a simpler way out. They used a system whereby a finned rocket was provided with a degree of spin by its launcher rails. This method, although rather crude in design terms and nowhere near as efficient as a proper spin-stabilized rocket, proved to be efficient enough for artillery use. Thus there appeared the Land Mattress, also in the later stages of the war in Europe and in insufficient numbers to make any real impression compared with the German artillery rocket batteries.



Above: Perhaps the most successful of British designs was 'Hedgehog', a rocket-propelled depth charge which enabled escorts to engage enemy submarines from all angles rather than having to drop conventional bombs from the stern. 'Hedgerow', a land version, was used in Normandy.

Below: Members of a Canadian rocket unit study their Land Mattress rocket system, a soundly designed weapon that was introduced too late and in too small numbers to make a significant impact.



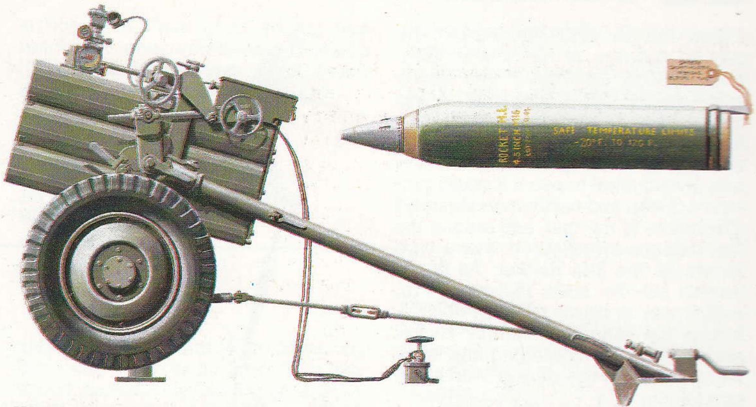
USA

Rocket, HE, 4.5-in, M8

When the USA entered the war in 1941, the US forces had no rockets at all in service or in prospect, but with typical energy the Americans used their considerable industrial potential and technical knowledge to remedy this deficit with great speed. In what seemed like no time at all they had erected huge facilities for producing rocket propellants of all kinds and were busy designing and producing rockets for all purposes. One of these rockets was a relatively straightforward fin-stabilized weapon known initially as the **T12** but later standardized as the **Rocket, HE, 4.5-in, M8**. This nose-fused 114.3-mm (4.5-in) rocket was destined to be fabricated in larger numbers than any other World War II artillery rocket, no fewer than 2,537,000 being produced by the time the war ended. The **M8A1** and **M8A2** were slight variations of the M8 and were used in the same manner: the former had a strengthened motor body and the latter had a smaller warhead with thicker walls. The **M8A3** was an M8A2 with modified fins.

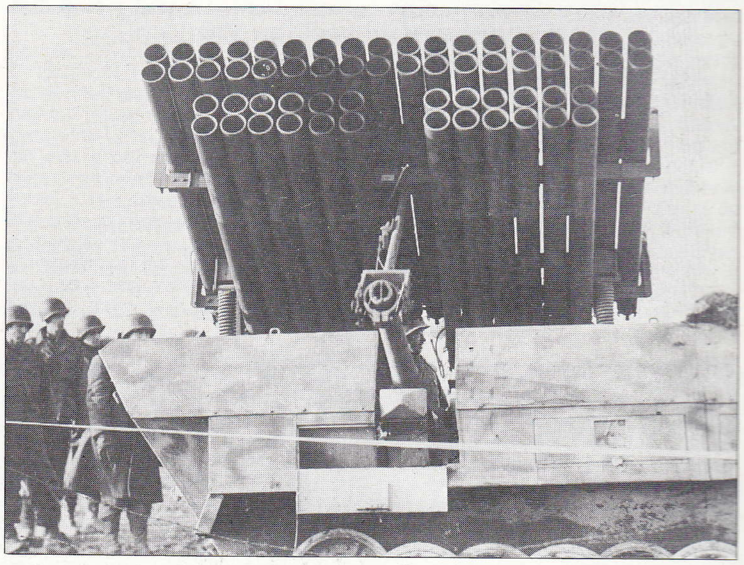
Being only fin-stabilized, the M8 was inherently inaccurate and was accordingly used not for the engagement of point targets but for the saturation of large areas with fire. Thus it was used extensively for the mass bombardment of target areas before amphibious landings or as a supplement to massed artillery bombardments. Even at short ranges its accuracy was erratic, so nearly all the launchers used with the M8 were multiple types. Typical of these was the **T27 Multiple Rocket Launcher** which fired eight M8 rockets and was carried on the back of a GMC or Studebaker 2½-ton truck. There were several variations of this launcher, one (the **T27E2**) with capacity for up to 24 rockets. The **T34** or **Calliope** was a large launcher carried over the turret of an M4 Sherman medium tank. The Calliope had no fewer than 60 launching tubes and was constructed from plywood as it was a one-shot weapon for use against strongpoints. After firing or in an emergency the whole device could be jettisoned. The **T44** was even larger than the Calliope as it had 120 launcher tubes, and was designed for installation in the cargo area of a DUKW or LVT amphibious vehicle. This was a simple area-saturation launcher as there was no method of varying elevation or traverse. A similar device known as the **Scorpion** but mounting 144 launchers was used on DUKWs in the Pacific theatre. The **T45** was a twin 14-barrel launcher that could be fitted to the sides of various vehicles, including light trucks. Yet another launcher that fired the M8 rocket was the **M12** which was a single-shot 'bunker-buster' along the lines of the British LILO.

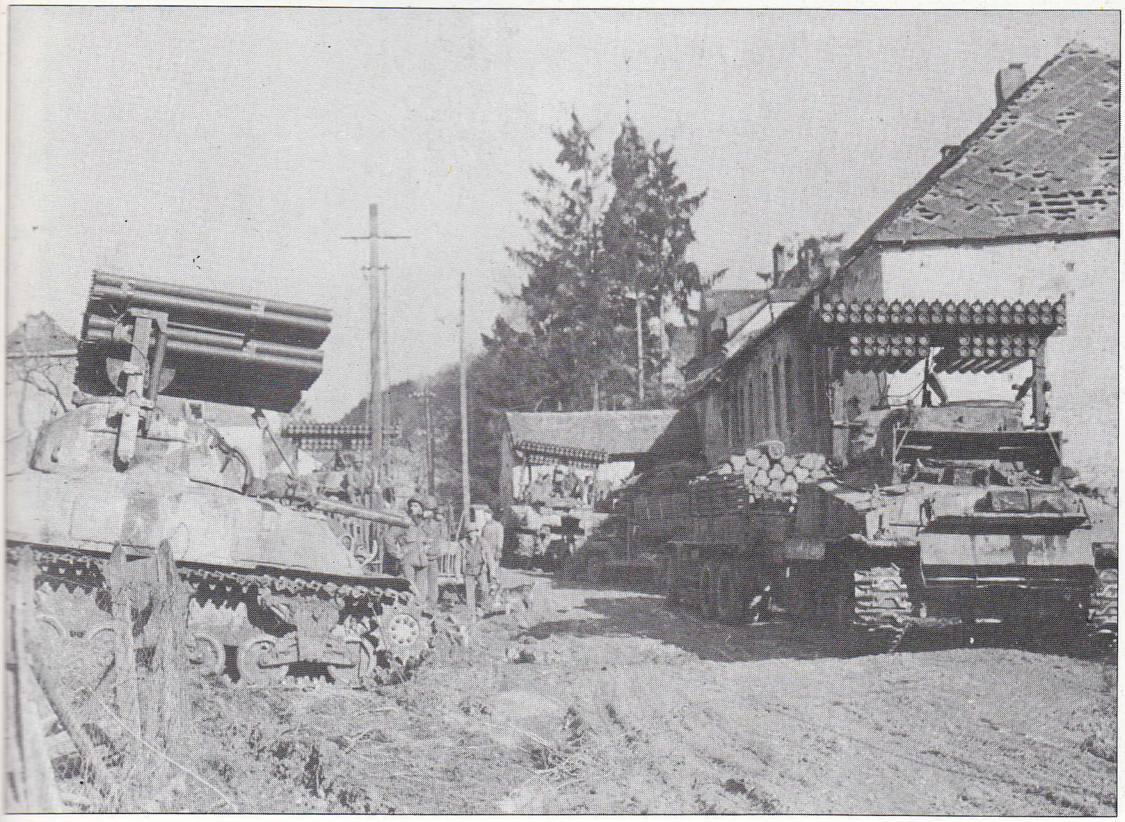
Despite the large-scale use of the M8, its inaccuracy was such that it was considered inadequate as an artillery rocket. Using knowledge gained from trials with captured German rockets, the Americans developed a 114.3-mm (4.5-in) spin-stabilized rocket known as the **M16**, along with a multiple launcher known as the **T66** which could fire 24 rockets in two seconds. This combination arrived on the battlefronts somewhat late in the war and was used during only one engagement in Germany before the end of the war in Europe. It was not used in the Pacific theatre, but was retained on the books for some years after 1945.



When America entered the war the US Army had no rockets in service and none on the drawing board, but after a little experimentation the M8 4.5-in rocket was put into production and proved highly successful, over 2½ million being manufactured by 1945.

Right: An unusual mounting for the M8 – a captured German half-track carries the 60-tube launcher more commonly fitted to tanks. A fin-stabilized projectile, the M8 was erratic in flight and needed to be fired in quantity to guarantee a hit.





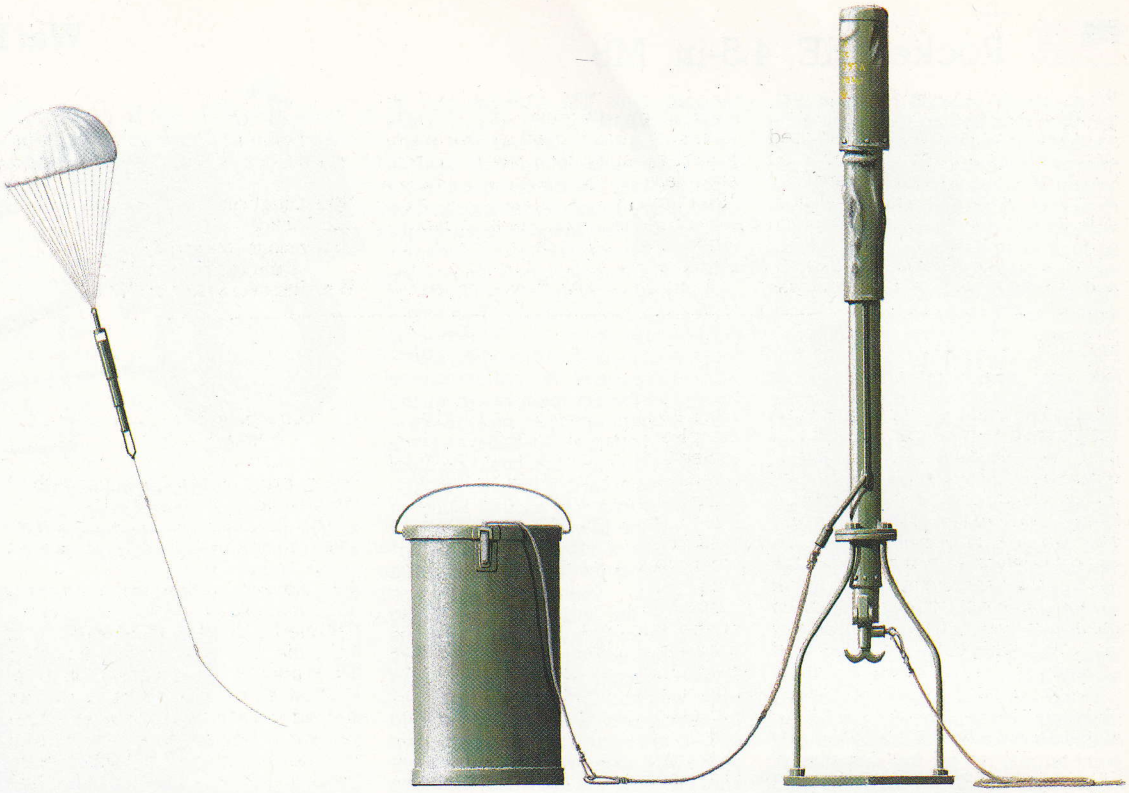
Specification
Rocket, HE, 4.5-in, M8
Dimensions: length 838 mm (33 in); body diameter 114.3 mm (4.5 in)
Weights: overall 17.5 kg (38.5 lb); propellant 2.16 kg (4.75 lb); explosive 1.95 kg (4.3 lb)
Performance: maximum velocity 259 m (850 ft) per second; maximum range 4205 m (4,600 yards)

Left: M4 Sherman tanks sport the T-34 60-tube launcher known as Calliope. The tubes were made of plywood and could only be used a few times before disintegrating, but the launcher provided tank units with awesome close-range firepower.

Above: A gunner checks the sights of the simple T-27 eight-tube launcher, generally fitted to GMC or Studebaker 2½-ton trucks. The M8 was also fired from massive 120- or even 140-round launchers fitted to DUKW amphibious vehicles for beach assault.

UK

2-in Rocket



The 2-in rocket was an ingenious, if over-optimistic, anti-aircraft weapon, being designed to destroy low-flying aircraft by fouling their propellers with the long wire it left in its wake.

During the late 1930s the need for improved defence of the United Kingdom against air attack was finally appreciated, but at the time it was thought that to produce enough anti-aircraft guns to meet immediate needs would take too long . Thus the rocket was investigated to see if it could provide a cheap and easily-manufactured alternative to the gun, and among the first designs investigated was a type known as the **2-in Rocket**. As things turned out the later 76.2-mm (3-in) rocket was to prove more promising, but at the time the smaller rocket seemed quite encouraging and work went ahead on the design with some momentum.

The 51-mm (2-in) rocket was a simple device that used a propellant known as solventless cordite or SCRK. The overall simplicity of the weapon could be seen in the fact that the earliest designs used a direct-action wind vane on the nose to arm the fuse after firing, with a self-destruct timer to destroy the weapon after it had been in flight for 4.5 seconds, by which time it would have reached a maximum height of about 1370 m (4,500 ft).

In the event the 51-mm (2-in) rocket was used mainly to arm light naval vessels and some merchant shipping. There were many and various simple naval mountings such as the basic vertical launchers that were mounted on each side of the bridge on many light vessels. These were supposed to launch their rockets as a low-flying aircraft attacked the ship. As the rockets rose they were designed to carry aloft a length of light wire that would enmesh itself in the aircraft's propellers and bring it down. The system never worked and neither did many other similar and somewhat optimistic devices. There was a high explosive version that could carry a 0.25-kg (0.56-lb) warhead, but by the time this was ready it was appreciated that the larger 76.2-mm (3-in) rocket was much better for this role and relatively few 51-mm (2-in) rockets were produced.

One naval mounting that was used on land was the one known as the **2-in Rocket Mounting Mk II, Pillar Box** mounting. This was used during the desperate days of 1940 and 1941 to provide at least a measure of coastal anti-aircraft defence, and could launch up to 20 rockets. The rockets were arranged in two vertical rows of five on each side of a central drum housing in which the aimer operated the simple controls. This drum housing gave the Pillar Box mounting its name. The aimer could fire all 20 of the rockets in one salvo or two salvoes of 10 rockets using electrical ignition.

Other forms of land-mounted 51-mm (2-in) rocket launchers existed and were used but only in very small numbers as temporary defensive measures. The 51-mm (2-in) rocket was really too small and light to have any great destructive effect, but the lessons learned in the design and development of these early attempts at war rockets had a good effect on later designs.

Specification

2-in Rocket

Dimensions: length 914.4 mm (36 in); body diameter 57 mm (2.25 in)

Weights: overall 4.88 kg (10.75 lb); warhead 0.25 kg (0.56 lb)

Performance: initial velocity 457 m (1,500 ft) per second

UK

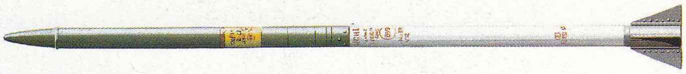
3-in Rocket

Design work on British artillery rockets started as early as 1934, though only on a low-priority basis, and by 1937 had reached the position where a **3-in Rocket** was proposed as an alternative to the anti-aircraft gun. Under strict security conditions, development of the new rocket went ahead with the cover name **UP** (unrotated projectile). Early firings were made at Aberporth in Wales, and by 1939 the final test firings were being made in Jamaica. These led to the establishment of the first operational battery near Cardiff in South Wales, where it was known as a 'Z' battery.

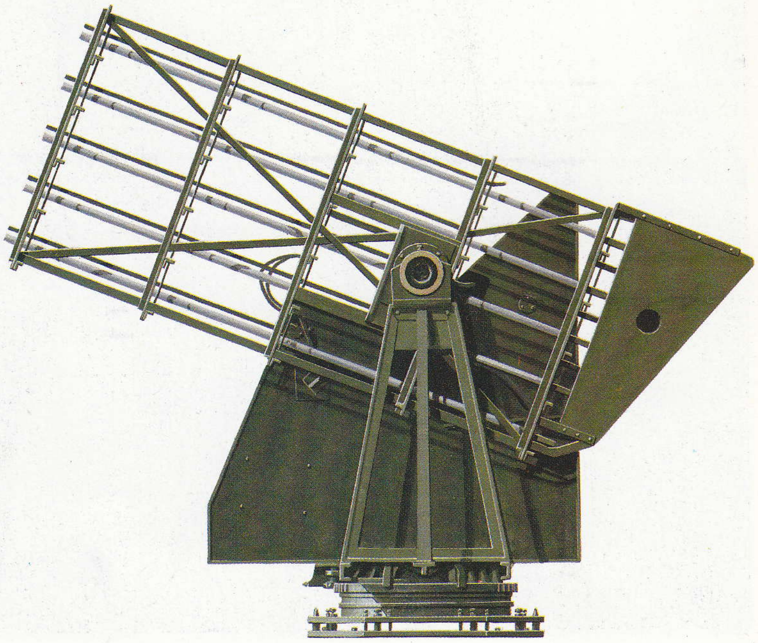
This first Z battery used a single-rail launcher known as the **Projector, 3-in, Mk 1**. It was a very simple, even crude device and it was produced for both the army and the Royal Navy, although in the event most of the Royal Navy's allocation went to the merchant navy. The rocket was a simple fin-stabilized tube containing a motor and the same SCRK cordite used on the 51-mm (2-in) rocket. These early designs were somewhat erratic in performance, and accuracy was such that huge salvoes had to be fired from all the projectors in a Z battery in order to have some chance of hitting an aircraft target. They did have their successes, but they were few and not improved until the **Projector, Rocket, 3-in, No. 2 Mk 1** came along. This used a two-rail launching system and was produced in some numbers, still firing the 76.2-mm (3-in) rocket but fitted with more sophisticated fusing systems including early attempts at proximity fusing and other electro-magnetic devices. Some of these No. 2 projectors saw action in North Africa, including port defence at Tobruk.

The next improvement in launching methods was the **Projector, Rocket, 3-in, No. 4 Mk 1** and **Mk 2**. This had no fewer than 36 launcher rails to fire nine rockets in a ripple sequence. This projector was mobile as it was carried on converted 76.2-mm (3-in) anti-aircraft platform trailers. Again some of these projectors were used in North Africa.

The largest of all the British 76.2-mm (3-in) rocket projectors was the **Projector, Rocket, 3-in, No. 6 Mk 1**, which could fire 20 rockets in four salvoes. This entered service in 1944 and was intended for use in static locations for



Designed originally as an anti-aircraft system, the 3-in rocket achieved modest success as a ground weapon. However, it is better known as an air-to-ground weapon, fired from Hawker Typhoons over Normandy.



home defence. By the time they were ready many were manned by Home Guard units as they were considered simple enough for relatively untrained users, especially when they were fired en masse by battery at easily-visible targets. In the event they were little used.

One unexpected offshoot from the anti-aircraft rocket programme was that the 76.2-mm (3-in) rocket was taken up as an aircraft weapon. Fired from short launcher rails it proved to be a devastating ground attack missile, especially against tanks, and during 1944 proved to be one of the most powerful of all anti-tank weapons when used by 'cab-rank' Hawker Typhoons over the Normandy battlefields. By the time the war ended the airborne 76.2-mm (3-in) rocket had reached a considerable state of design development and was even being used to sink U-boats.

Specification

3-in Rocket
Dimensions: length 1.93 m (76 in); body diameter 82.6 mm (3.25 in)
Weights: overall 24.5 kg (54 lb); propellant 5.76 kg (12.7 lb); warhead 1.94 kg (4.28 lb)
Performance: maximum velocity 457 m (1,500 ft) per second; service ceiling 6770 m (22,200 ft); horizontal range 3720 m (4,070 yards)

UK

LILO

By 1944 the Allies were becoming accustomed to the Japanese tactic of using heavily-protected bunkers to delay Allied advances, not only on the Pacific Islands but also in the land warfare raging in South East Asia. The only effective way to demolish these formidable defensive works was by the use of heavy artillery at close ranges, but the Japanese did not always build their bunkers where such heavy weapons could get at them. The rocket was obviously a relatively portable method of dealing with such obstacles, and thus there emerged a programme known by the cover name **LILO**.

LILO was a very simple single-barrel launcher designed to fire a rocket at short range against bunker-type targets. It fired a projectile powered by the Motor, Rocket, 3-in, No. 7 Mark 1 to which two types of warhead could be fitted. Both were HE types, one weighing 17.8 kg (39.25 lb) complete and the other 35.5 kg (78.25 lb) complete. The idea was that the LILO projector could be carried to its firing location by one man, with another carrying a rocket on a suitable backpack. The projector was then set up as close to its intended target as possible and the rocket loaded into the launcher tube from the front. Open sights were used to aim the weapon, the back legs of the launcher being moved for changes in elevation. When all was ready the rocket was fired electrically, using a light 3.4-volt battery. The LILO rockets were capable of penetrating 3.05 m (10 ft) of earth plus a layer of logs, so they could normally penetrate any Japanese bunker. But the main problem was hitting the target: despite the fact that a degree of spin was imparted to the rocket as it was launched, the inherent inaccuracy of the rocket was such that to ensure a 95 per cent chance of hitting a point target distant only some 45 to 50 m (49 to 55 yards), five rockets had to be fired. This may sound uneconomic but the alternative was to bring up heavy artillery with all its attendant risks and labour.

The Americans also used a short-range rocket for the same purpose as LILO. Their device was known as the **M12 Rocket Launcher** which fired a 114.3-mm (4.5-in) rocket, and this resembled LILO in many ways apart from the fact that the first launcher tubes used were plastic and were discarded after firing. Such a system proved to be too wasteful, even for the US war economy, so a later version was developed as the **M12E1** which used a magnesium alloy tube that could be reloaded and reused. These projectors were used during the latter stages of the fighting on Okinawa when the Japanese defenders had to be blasted from their heavily-defended caves.

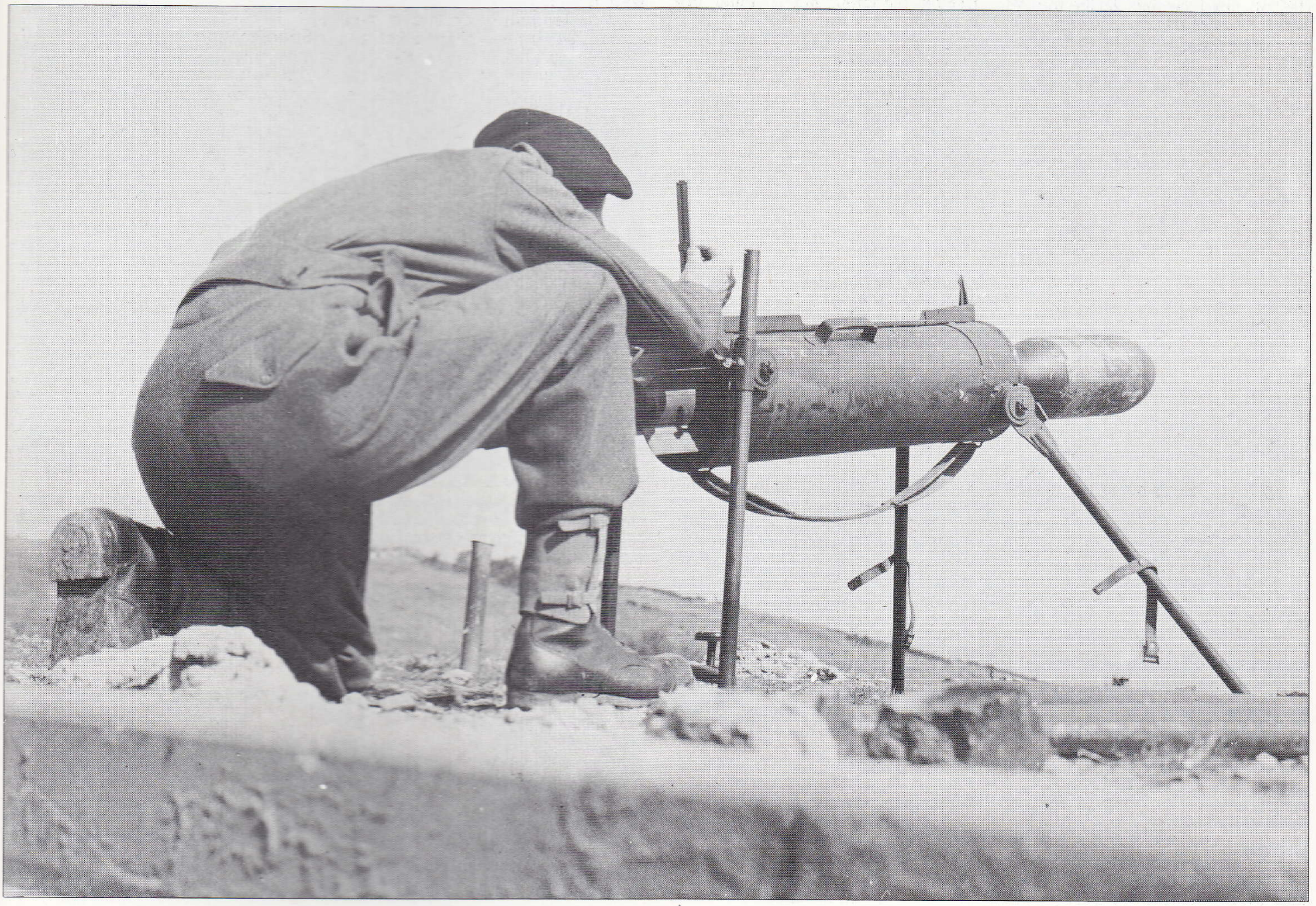
Specification

LILO rocket (9.53-kg/21-lb warhead)
Dimensions: length 1.238 m (48.75 in); body diameter 82.55 m (3.25 in)
Weights: overall 17.8 kg (39.25 lb); propellant 1.93 kg (4.25 lb); explosive 1.8 kg (4 lb)
Performance: not stated

Specification

LILO rocket (27.2-kg/60-lb warhead)
Dimensions: length 1.321 m (52 in); body diameter 152 mm (6 in)
Weights: overall 35.5 kg (78.25 lb); propellant 1.93 kg (4.25 lb); explosive 6.24 kg (13.75 lb)
Performance: not stated

As the Allies drove the Japanese back towards their homeland, numerous expedients were tried to knock out the toughly-constructed bunkers that were the hallmark of Japanese positions. One such was LILO – a short-range single-shot 60-lb (27-kg) rocket.



UK

Land Mattress

Although early development of the war rocket in the United Kingdom was initially to produce an anti-aircraft weapon, some consideration was also given to producing an artillery rocket. One early attempt at this was a design for a 127-mm (5-in) rocket which was rejected by the army but adopted by the Royal Navy for use in modified landing craft for the saturation of landing beaches and approaches by massed rocket fire. This eventually evolved as the **'Mattress'**, but range was limited. However, further trials revealed that the range could be improved by introducing, at launch, a degree of spin which would also improve accuracy, and this was simply achieved by using an aircraft 76.2-mm (3-in) rocket motor attached to a naval 13-kg (29-lb) warhead. This increased range to a possible 7315 m (8,000 yards), making the artillery rocket a viable proposition once more. Thus 'Mattress' became **'Land Mattress'**.

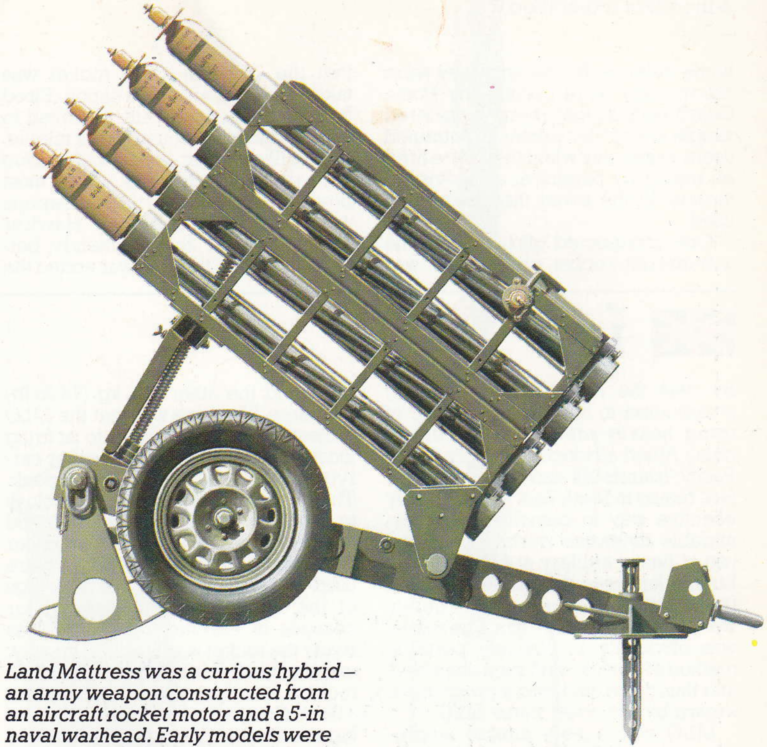
The first army launchers for these new Land Mattress rockets had 32 barrels, but a later version had 30 barrels. Demonstrations of this launcher greatly impressed Canadian army staff officers, who requested a 12-launcher battery which in the event was ready for action on 1 November 1944. This battery went into action during the crossing of the River Scheldt and was a great success, to the extent that more were requested and produced. The Land Mattress launcher was limited in its elevation capabilities to between 23 and 45°, and this not only limited the maximum range to 7225 m (7,900 yards) but also limited the minimum range to 6125 m (6,700 yards). To reduce the minimum range possible, a system of rotary spoilers over the rocket exhausts was formulated and put into use. The rotary spoiler disturbed the exhaust gases by closing off their efflux by varying amounts, and thus reducing the minimum range to 3565 m (3,900 yards).

For all the success of the Land Mattress, not many equipments were used in action before the war ended in Europe in May 1944. By that time many were only just emerging from the factories ready to be sent off to South East Asia, but their use there was very limited, as a result mainly of the weight and bulk of the projectors in the area's jungle conditions. A special 16-barrel version was accordingly developed for towing by a Jeep, but the war was over by the time it was ready for service.

In action, a single Land Mattress projector salvo could result in 50 per cent of the rockets falling in an area 215 m (235 yards) long by 219 m (240 yards) wide. The rockets were fired in ripples at 0.25-second intervals so that the entire salvo could be fired in 7.25 seconds. During the crossing of the Scheldt the first Land Mattress battery fired 1,146 rounds over a six-hour period. As each warhead payload weighed 3.18 kg (7 lb), the effects can well be imagined.

Specification

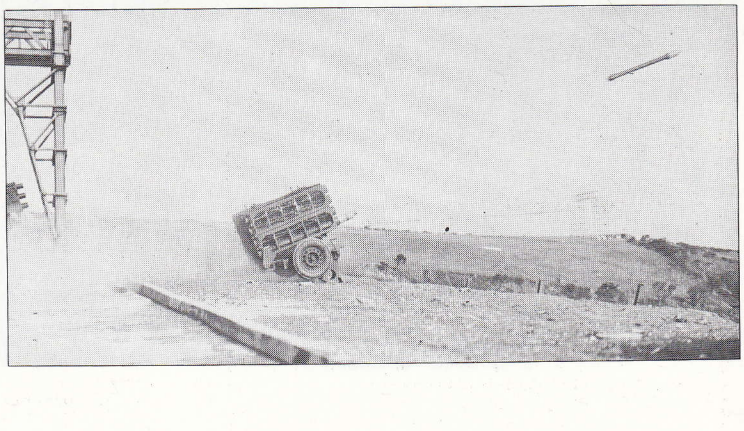
Land Mattress (rocket)
Dimensions: length 1.77 m (69.7 in)
Weights: overall 30.5 kg (67.25 lb); propellant 5 kg (11 lb); payload 3.18 kg (7 lb)
Performance: maximum velocity 335 m (1,100 ft) per second; maximum range 7225 m (7,900 yards)



Land Mattress was a curious hybrid – an army weapon constructed from an aircraft rocket motor and a 5-in naval warhead. Early models were severely restricted in performance since elevation was restricted between 23° and 45°.

Above: Loading 30.5-kg (67-lb) rockets into the 32-round launchers was an exhausting job, but to be effective rockets had to be fired in big volleys. The first Land Mattress battery fired over 1,000 rounds in six hours during the crossing of the Scheldt.

Above: Loaded and ready to fire, the crews make their final checks before taking cover. Fired at a rate of four a second, half the rockets from a 32-round projector would hit a target zone 215 m (235 yards) long and 219 m (240 yards) wide.



Right: Land Mattress spent more time on the test range than in action. After much experimentation, minimum range was reduced and a light 16-round launcher was developed for jungle warfare.